भारतीय सूचना प्रौद्योगिकी संस्थान कोटा
INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTA
2nd Floor, Prabha Bhawan, MNIT Campus, J.L.N Marg, Jaipur -302017
Ph: 0141-2715071, E-Mail: office@iiitkota.ac.in

No: IIITK/2021-22/R&D/407 3 Date: February 18, 2022

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Dr. Deepasree Varma is Co-Principal Investigator in the project entitled "Cross-lingual knowledge transfer for social media analysis in less-resourced languages during COVID-19", which is approved by the Department of Science & Technology (International Bilateral Co-operation Division) under the scheme India-Slovenia Bilateral Scientific and Technological Cooperation, Government of India. The file number is DST/ICD/Slovenia/P-15/2021 (TPN: 55580). The cost of the project is Rs.16,64,640/- for a duration of three years.

Please feel free to contact me for any further information at basant.cse@iiitkota.ac.in

Dr. Basant Agarwal,
Principal Investigator,
Assistant Professor, IIIT Kota

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CENTRE FOR ENGINEERING RESEARCH AND DEVELOPMENT
College of Engineering Trivandrum Campus
Thiruvananthapuram. Pin 695016.

APPLICATION FORMAT FOR STUDENT PROJECT

SECTION A: GENERAL INFORMATION

1. Name of the Principal Investigator :VINOJ P G, ASSISTANT PROFESSOR,ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT,SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY,KARUKUTTY

   (Faculty who is guiding the project)

   Phone no :9446276238

   Email id :vinojpg@scmsgroup

2. Name of the Co-Investigator : SREEJA RAJESH, ASSISTANT PROFESSOR,COMPUTER SCIENCE AND ENGINEERING DEPARTMENT,SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY,KARUKUTTY

   (Faculty who is co- guiding the project)

   Phone no : 9496886028

   Email id : sreejarajesh@scmsgroup.org

3. Name(s) of Student investigators : AKHIL PAULSON,JESLIN MARY SAJEEV, KAVYA KRISHNA,NISHA BENNY

   Semester : S7 BTECH

   Branch : ELECTRONICS AND COMMUNICATION

4. Address of the Institution : SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY,KARUKUTY-683576,ANGAMALY

5. Title of the project proposal : IOT powered Intelligent Biodegradable Mask and Gloves Disposal unit for COVID-19

(Attach biodata of 1, 2 & 3)

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CENTRE FOR ENGINEERING RESEARCH AND DEVELOPMENT
College of Engineering Trivandrum Campus
Thiruvananthapuram - Pin 695016.

4.

APPLICATION FORMAT FOR STUDENT PROJECT

SECTION B: TECHNICAL DETAILS

1. (a) Title of the Project Proposal: IOT powered Intelligent Biodegradable Mask and Gloves Disposal unit for COVID-19

(b) Branch / Subject area : Electronics and Communication Engineering/ DISINFECTION SYSTEM

(c) Project Type (Developmental / Demonstration / Others): Demonstration

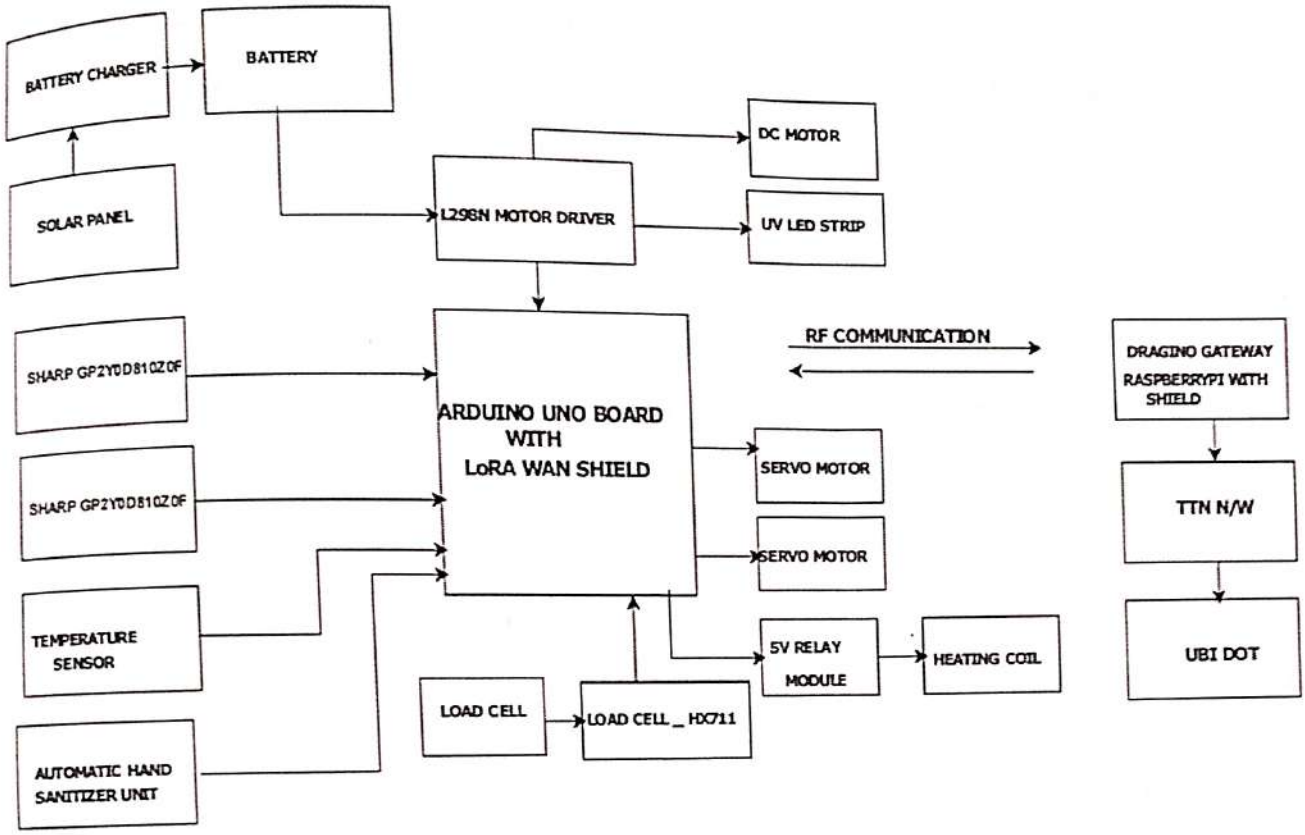
2. Precise objective (150 words):

Corona Virus hit the World at it's spine and the lives of the people had been trembled e since. As it has no intention to stop spreading by it's own, scientists have been working day a night for the invention of vaccine. Social distancing is the only known precaution, and masks a gloves will increase the chance of not getting infected. The safe disposal of masks and glove as important as wearing those. The automatic disinfection of the floor and the tempera detection of the crowd using thermal imaging sensor is also incorporated. That is where our i is relevant in the current social scenario. As the Covid-19 still threatens the life of the people, number of masks and gloves used per day is on a toll. People should pack the used masks a gloves in proper manner and hand them over to the sanitary workers, corporation offici hospitals or other concerned authorities. Improper disposal of masks and gloves can cre virulent transmission of many diseases. In order to overcome this hassle, we have implemen an automatic three stage disposable plant. This will turn out to be a priceless asset for a community.

3. Abstract (400 words):

The world has been facing difficult times since December 2019 after the widespread of the nov corona virus. With the number of affected increasing day by day, social distancing is the on preventive method known. Health care and biologists are working round the clock for inventio of vaccination to fight the corona virus. WHO recommends usage of mask and gloves as a effective solution against the virus spread. With people returning to their normal life, the numbe of masks and gloves used per day is on a toll. The next hassle we face would be improp disposal of used masks and gloves that neither comes under medical waste or normal waste. Th temperature detection of crowd and the automated disinfection of the floor is another challeng The collection of such used masks and gloves by a garbage collector is unsafe as it can furth cause spread of the virus. To ease the collection and fumigation of such used masks and glove with temperature monitoring and floor disinfection we propose a fully automatic 3 stag disposable plant which can be implemented at public place. Our product is cost effective and th materials and energy sources used are pollution free, which helps in keeping the environme clean. The unit has an intake capacity of 4 kg at a time. It is fully automatic, can save labour cos time and effort required for collection by workers.

4. Methodology including the work plan:
(Attach separate sheet if needed)



The first stage of the unit is a collection tray in which the count of gloves and masks disposed is determined by IR sensors. The bin can also measure the load of the waste using a load cell kept over the flap. When the set count of masks and gloves is reached, the sanitizer unit connected to a DC motor pumps and sprays the liquid on the disposed materials. If the number exceeds 10,000 in count or the weight on the load-cell exceeds 4kg, the flap will rotate in the clockwise direction by 180 degrees and the disposed materials reaches the second stage. Here, the flap is exposed to UVC light for 40 minutes via UVC light strip which is turned on for 30 minutes by enabling a timer. Once the timer is reset, the flap will again rotate, and the waste moves onto the collecting tray kept in the third stage. This stage consists of a heating coil controlled with a relay, timed up for the temperature of 100-200 degree centigrade. The disposed wastes shrink to the size of small cotton balls and are completely disinfected. An automatic hand sanitizer dispenser attached will help in hand sanitization before disposal. The base of the unit is incorporated with sweeping brush attached to motor for automatic floor disinfection. A thermal imaging camera is incorporated to detect the thermal signature of the person in the crowd. If the threshold is above the limit the alarm for that thermal imaging will be raised. The complete data transfer is done using LORAWAN and IoT. Moreover, the whole mechanism runs on Solar energy which is renewable and causes no long-term damage to the environment. This entire 3 stage unit proposed is designed and made out of clay, which is a natural, eco-friendly binder thus eliminating the threats imposed by constructing a plastic unit. No such unsustainable energy sources are being used that can deteriorate the future requirements. The device is also equipped with thermal imaging camera for the temperature detection of crowd and automatic sanitiser dispenser unit. The base of the device is having sweeping brush which sanitise the floor, once the charging reaches to critical limit it will find the charging destination automatically. The unit is controlled by LORAWAN-IoT for the data transfer and remote analysis. Our present findings can thus help the regulatory authority to set forth the steps for safe disposal of masks, gloves and PPE kits in an ecologically sustainable manner.

Phase	Outcomes	Means/ Tools	Duration
1	Interfacing Sensor with controller	**Components:-** Arduino Uno, Sharp IR sensor module,Temperature sensor,Load cell,bread board **Tools:-** Arduino IDE, PCB design software	2 week
2	Interfacing actuators with controller	**Components:-** Arduino Uno ,Servo motors,DC motor,Heating coil, relay,L293D Motor Driver **Tools:-** PCB Design Software, Arduino IDE	2week
3	Design of Solar unit	**Components:-**Solar Panel, charging circuit,battery,Bread board	2 week
4	Establishing IoT communication	**Components:-** Raspberry Pi 4, NodeMCU, Lorawan Sheild, Dragino gateway **Tools:-** PyTorch, ArduinoIDE, Cloud API	2 weeks
5	Deployment,Assembly and testing	**Tools:-** 3D printer, Laser cutter/ CNC machine, 3D modeling softwares,	6 week

5. Application / importance in the socioeconomic context:
   1. Automated safe disposal of masks and gloves
   2. Prevent spreading of Covid-19 and other Infectious diseases
   3. Ease the collection and fumigation of such used masks and gloves
   4. Additional Features of temperature monitoring and floor disinfection are integrated
   5. The product is cost effective and the materials and energy sources used are pollution free
   6. Helps to maintain healthy and clean Environment
   7. LORAWAN and IOT enables remote data analysis and monitoring

6. Particulars of equipment required: NA
   (Equipment only to govt / govt supported institutions)

7. Particulars of any other facilities required:
   1) 3D printers
   2) Soldering and Drilling machine
   3) Electronics work bench
   4) Laser Cutter
   5) PCB Milling Machine,CRO,Digital Oscilloscope

8. Particulars of the facilities that will be provided by the institution where this project will be implemented:
   1)3D printers
   2) Soldering and Drilling machine
   3) Electronics work bench
   4) Laser Cutter
   5) CRO,Digital Oscilloscope

9. Whether the scheme was submitted to any other organization for financial support, if so, the names of the institutions and their decisions may be indicated: NO

10. Budget Details: Estimated expenditure

Sl No	Items	Amount (Rs)
1	Consumables **(Do not exceed 20% of the total amount)**	10,000/-
2	Equipment (For Private self financing Colleges, 50% of the actual Equipment cost subject to the maximum of sanctioned amount shall be borne by the college)	10,000/-
3	Travel **(Do not exceed 10% of the total amount)**	5,000/-
4	Contingency **(Do not exceed 10% of the total amount)**	5,000/-
	Total	30,000/-

Budget Justification:

1. Consumables : Rs 10,000/-(Ten Thousand) : Purchase of components like Arduino Uno, Rasberry pi Microcontrollers, IRSensor,Load cell, Servo motors, Dc Motors

2. **Equipment :** Rs 10,000/-(Ten Thousand) :Purchase of electronic Equipment like Multi-meter, soldering Iron, IOT dragino Gateway, Lorawan sheild

3. **Travel**: Rs 5,000/-(Ten Thousand)
Travel Budget will be utilized for meeting doctors, NGO and subject experts

4. Contingency: Rs 10,000/-(Ten Thousand)
Contingency Fund is utilized for patent filing, medical committee approval, to cover unforeseen risks during device testing

Signature of Principal Investigator:
Name, Address & Telephone No:

VINOJ PG,
ASSISTANT PROFESSOR,DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING,SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY,KARUKUTTY-683576
MOB:9446276238

Place : Karukutty
Date :17/02/2022

Office Seal

THE SOLAR POWERED SMART MASK AND GLOVES DISPOSABLE UNIT

SREELAKSHMI T U
NIRANJAN SANTHOSH
SALIL C L
SIDHARTH K S

e No 0484-2459029

900470299 M/S CERD RESEARCH-SEED MONEY 2 4643 2220

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ाता क्र. 588802010007682 (SB GENERAL)

c No.

Cust Id : 900470299

MICR Code :

IFSC Code : UBIN0558885

बचत बैंक खाता
पास बुक

CUSTOMER Care No:18002242244

SAVINGS BANK
PASS BOOK

नामांकन सुविधा उपलब्ध
Nomination facility available

About Dormant Accounts :- "Savings Bank Accounts, which are inoperative for a continuous period of months will be classified as Dormant. Operations will not be allowed in Dormant Account. Customers requested to contact the Branch Manager for reactivating the account and are requested not to issue cheques on dormant accounts before they are reactivated".

About alterations / overwritings on cheque :- "No Changes / corrections should be carried out on cheques. For any change in the payee's name, amount (other than date for validation purposes) etc cheque forms should be used." www.unionbankonline.co.in

यूनियन बैंक ऑफ इंडिया
भारत सरकार का उपक्रम
Union Bank of India
A Government of India Undertaking
आन्ध्रा Andhra
कार्पोरेशन Corporation

SCMS COLLEGE OF ENGG AND [illegible]
VIDHYA NAGAR, PALISSERY, [illegible]SERY-683502
0484-2439029

यूनियन बैंक ऑफ इंडिया Union Bank of India KERALA

आन्ध्रा Andhra | कार्पोरेशन Corporation

शाखा BRANCH

शाखा का पता Branch Address : 588802010007682

शाखा का फोन नं/ Branch Phone No.: GENERAL)

खात क्र. Account No.: M/S CERD RESEARCH SEED MONEY 2 4643 2020 01

In the Name of :

नाम Name i)

ii) 9999,SCMS ENGG COLLEGE

iii) GENEV 8888,VIDHYA NAGAR

20-09-2021 Pin : 683576 ADEN

पेशा Occupation

पता Address N Branch Phone No : 0484-2439029

खाता खोलने की तारीख
Date of Opening A/c

नामांकन पंजीकृत / Nomination Registered : हाँ Y / नहीं N

लेखाकार A

दिनांक Date	विवरण Particulars	सोल आयडी SOL ID	चेक नं. CHQ. No.	निकाली गयी राशी DEBIT	जमा की गयी राशी CREDIT	जमा कर्ता के खाते में शेष राशी BALANCE
03-2022	NEFT:Director of Treasuries account f47380				50000.00	
04-2022	SBBS02010007652:Int.Pd:01-01-2022 to 31-03-2022				10.00	

KERALA STATE COUNCIL FOR SCIENCE, TECHNOLOGY AND ENVIRONMENT
An Autonomous body of the Government of Kerala

KSCSTE - Student Project entitled –**"Data abstraction of vehicles on crashing (DAVOC)"** submitted by Mrs.Hazel Elsa John, Assistant Professor, Electronics & Communication,SCMS School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576 Kerala as PI and Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahimas student investigator(s) - financial assistance - Orders issued.

Council (P) Order No366/2021/KSCSTE Dated: Thiruvananthapuram,05/10/2021

Ref: - 1. Decision of the 64th SP Committee meeting dated December 13, 2019 on item No. SP- 64_ (01300 /SPS 64/2019/KSCSTE)

2. KSCSTE/592/2020-SP

ORDER

Kerala State Council for Science Technology and Environment (KSCSTE) is operating a programme for supporting student projects in colleges and university departments. Mrs.Hazel Elsa John, Assistant Professor, Electronics & Communication, SCMS School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576, Kerala, has submitted a student project as PI with Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahimas student investigator(s) for financial assistance. The 64th SP Committee meeting dated December 13, has sanctioned **₹9800/-(Rupees Nine thousand and eight hundred only)** for the conduct of the above said project. The PI has submitted the final report and financial statements after completion of the project.

KSCSTE has verified the submitted documents and is pleased to accord sanction for the release of **₹7249/-(Rupees seven thousand two hundred and forty nine only)**towards financial assistance for the student project titled –**"Data abstraction of vehicles on crashing (DAVOC)"**submitted by Mrs.Hazel Elsa John, Assistant Professor, Electronics & Communication, SCMS School Of Engineering And Technology Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576, Kerala.The amount will be disbursed to **The Principal, SCMS School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576, Kerala**by means of Electronic Fund Transfer as per their bank details given below.

Beneficiary Account Name	**SCMS School of engineering and technology**
Beneficiary Account Number(SB/CC)	**345801010030000**
Beneficiary IFSC code	**UBIN0558885**
Name of bank	**Union bank of India , Palissery**
Beneficiary Address	**The Principal, SCMS School Of Engineering And Technology Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576 Kerala**

File No.KSCSTE

Beneficiary Phone No.	9446763487
Beneficiary E-mail ID	praveensal@scmsgroup.org

The expenditure in this regard will be met from the Council fund (III) Schemes and Programmes of KSCSTE - Student project scheme.

K P SUDHEER
EXECUTIVE VICE PRESIDENT,KSCSTE

To

The Principal, SCMS School Of Engineering And Technology, Vidya Naga
Palissery, Karukutty, Ernakulam - 683 576, Kerala

Copy to:

Mrs.Hazel Elsa John, Assistant Professor, Electronics & Communication, SCM
School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutt
Ernakulam - 683 576
Kerala

Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahi
Student(s),Bachelor of Technology (BTech), Electronics & Communication, SCM
School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutt
Ernakulam - 683 576, Kerala

The Cash Section KSCSTE, Auditors file, Stock File/Office Copy

Kerala State Council for Science, Technology and Environment

Prof (Dr.) K.P. Sudheer
Executive Vice President
KSCSTE, Pattom

16.01.2020

Letter No. 01300 /SPS 64/2019/KSCSTE

Dear Mrs. Hazel Elsa John,

Sub:-Financial assistance for Student Project scheme of KSCSTE reg.
Ref:-Your application received under Student Project scheme

This is to invite your attention to the reference cited and to inform that the project proposal titled "Data abstraction of vehicles on crashing (DAVOC)" submitted by Mrs. Hazel Elsa John as PI and Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahim as student investigator(s) has been approved. An amount of 19800/- is sanctioned by the Council. The budget estimate of the project is as detailed below.

SL.NO.	ITEMS	AMOUNT(₹)
1	Consumables	8900
2	Minor equipments	400
3	Travel	200
4	Research Literature & Documentation	200
5	Others (for analysis)	100
	Total	9800

The PI has to submit the signed Terms and Conditions (as per the guidelines) and the date of start of the project within two weeks to the undersigned. The project should be completed within six months and submit the certified soft copy of the final report (in pdf to **sed.kscste@kerala.gov.in**), audited Statement of Expenditure and Utilization Certificate counter signed by the Head of the Institution for releasing the grant. **The format for final report, SE and UC can be downloaded from www.kscste.kerala.gov.in .**

Thanking you.

Yours sincerely,

Prof (Dr.) K.P. Sudheer

To

Mrs. Hazel Elsa John, Assistant Professor, Dept. of Electronics & Communication, SCMS School Of Engineering And TechnologyVidya Nagar, Palissery, Karukutty, Ernakulam - 683 576

Copy to:

The Principal, SCMS School Of Engineering And TechnologyVidya Nagar, Palissery, Karukutty, Ernakulam - 683 576

Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahim, Student(s), Bachelor of Technology (BTech), Electronics & Communication, SCMS School Of Engineering And TechnologyVidya Nagar, Palissery, Karukutty, Ernakulam - 683 576

यूनियन बैंक Union Bank of India

Statement of Account

SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY EDUCATIONAL INSTIT

C/O SCMS SCHOOL OF ENGINEERING & T
SCMS CAMPUS PALISSERY
PADUAPURAM P O ERNAKULAM
City ERNAKULAM
State KERALA
Country INDIA
Zip 683582
Mobile No 918589054713
E-mail SUBHA@SCMSGROUP.ORG

Statement Date : 30/11/2021 09:31

Union Bank of India
Branch PALISSERY
Customer Id 137305091
Account No 345801010030000
Account Currency INR
Account Type Current Account
MICR Code
IFSC Code UBIN0558885

Records from 1 to 149. No more records available.

Statement Period From -23/11/2021 To 30/11/2021

Date	Remarks	Tran Id	UTR Number	Instr. ID	Withdrawals	Deposits	Balance
/11/2021	NEFT:Mr NOEL JOSEPH GOMEZ SBIN321329393862	S32261023	Sender No:SBIN321329393862			20,250.00	1,83,81,384.70
/11/2021	UPIAB/132975335288/CR/Mr Vyshn/IDIB/vyshnavkvinodh	S33060966	-			200.00	1,83,81,584.70
/11/2021	NEFT:SANIL P B SIBLN21330157518	S40833044	Sender No:SIBLN21330157518			1,80,000.00	1,85,61,584.70
/11/2021	UPIAB/133004295763/CR/JOEL SAB/UBIN/954482472 7@ybl	S41498816	-			200.00	1,85,61,784.70
/11/2021	UPIAB/133012389259/CR/ASHKAR /SBIN/ashkarsulaiman	S41503945	-			20,600.00	1,85,82,384.70
/11/2021	NEFT:RAZORPAY SOFTWARE PRIVATE LIMITED AXISCN01069	S43165614	Sender No:AXISCN0106 972557			1,67,650.00	1,87,50,034.70
/11/2021	UPIAB/133014833647/CR/SIVAPRAS/SBIN/ ht.sivaprasad@	S44432277	-			22,250.00	1,87,72,284.70
/11/2021	WEEKEND PASS	AA784416	-			4,650.00	1,87,76,934.70
/11/2021	MUHAMMED LAMY MTC/778	AA784416	-			30,000.00	1,88,06,934.70
/11/2021	IMPSAB/133016809180/UBIN0558885/94974 63767	S46400889	-			20,600.00	1,88,27,534.70
/11/2021	NEFT:KSCSTE SBIN421330046461	S47761762	Sender No:SBIN4213300 46461			7,000.00	1,88,34,534.70
/11/2021	NEFT:KSCSTE SBIN421330046470	S47763606	Sender No:SBIN4213300 46470			7,249.00	1,88,41,783.70
/11/2021	NEFT:KSCSTE SBIN421330046465	S47763873	Sender No:SBIN4213300 46465			7,441.00	1,88,49,224.70
27/11/2021	UPIAB/133145668827/CR/RANDEEP /IOBA/8301027135@ibl	S57550805	-			20,600.00	1,88,69,824.70
27/11/2021	UPIAB/133198999762/CR/JUNO THA/CNRB/junomatho w139@	S57612168	-			55,000.00	1,89,24,824.70
27/11/2021	UPIAB/133119088420/CR/ABHIRAM /UBIN/abhiramkv56@ ok	S66543801	-			600.00	1,89,25,424.70

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CET campus, Thiruvananthapuram - 695 016
Ph: 0471 2598122; Fax: 2598522 www. ktu.edu.in Email: university@ktu.edu.in

No. KTU/RESEARCH 2/4643/2020 Dated: 02.09.2021

From

The DEAN (Research)

To

The Principal
SCMS School of Engineering and Technology

Sir,

Sub:- APJAKTU - CERD - Research Seed Money Scheme - Projects Selected for funding - reg:-

I am glad to inform you that the project proposals as listed in Annexure I are provisionally selected for funding under Research Seed Money (RSM) scheme of KTU.

The expenditure should be incurred as per the sanctioned budget heads and in accordance with terms and conditions given in Annexure II. Format of MOU to be furnished by the college is given as Annexure III.

The Principal Investigators may please be directed to forward request (in Annexure II) for releasing the fund with Bank Account details. The fund will be released only after settling pending accounts of the principal investigator in CERD, if any. Any request received after three months from the date of this letter will not be considered.

Yours faithfully
Dr. Shalij P.R *
DEAN (Research)

Copy To

1. Vinoj P. G, Assistant Professor in ECE.
2. Y. K. Remya, Assistant Professor in Civil Engineering.
3. Susmi Jacob, Assistant Professor in Computer Science.

* This is a computer system (Digital File) generated letter. Hence there is no need for a physical signature.

Annexure II

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Centre for Engineering Research and Development
Request for releasing RSM grant

Title of Project:

Date of sanction:

Amount sanctioned:

Account No and bank details:

Terms & Conditions for Research Seed Money Scheme

1. The amount sanctioned for the project shall be deposited in a separate joint A/c of Principal Investigator and Head of the institution where the Principal Investigator works. (Name of A/c: CERD Research Seed Money - File No.)

2. The maximum duration of the project will be three years from the date of start of the project

3. The amount has to be utilized as per budget provision under each head. It is the discretion of the University to settle amount towards the purchase of those items not clearly mentioned, if any, in the project proposal.

4. The purchase of equipments shall be in accordance with the store purchase rules. All equipment purchased will be the property of CERD and the stock entry of the items purchased shall be maintained in the College signed by the Investigator, Lab in charge and Principal. Purchase of computers/peripherals is not allowed unless specifically mentioned in the sanction order.

5. For Private self financing Colleges, 50% of the actual Equipment cost subjected to the maximum of sanctioned amount will be reimbursed by KTU if and only if the proof of remittance of other 50% is produced by the college.

6. The stock entries of consumables purchased shall also be done in the consumables stock register of College. Purchase of stationery shall be for project purpose only.

7. Books and literature purchased should be taken into the Stock Register of Central Library or Department library and then distributed to the investigators.

8. The interest accrued will also be accounted in the project.

9. On completion of the project, detailed report of the research work (hard and soft copies), audited statement of accounts and Utilization Certificate in the prescribed format duly attested by the head of the institution shall be submitted within one month on completion of the project for settlement of accounts.

10. If the project is not completed within the time limit, the grant amount should be reimbursed along with the interest accrued.

11. The CERD reserves the right to terminate the project at any stage if it is convinced that the grant has not been properly utilized or appropriate progress is not being made. In addition, the CERD may designate Scientist/Specialist or an Expert Panel to periodically review the work done. The Principal Investigator has to appear for the periodic review meetings.

12. If the PI to whom the project has been sanctioned, leaves the Institution, the Head of Institution/PI shall inform the same to the CERD and in consultation with the CERD, evolve steps to ensure successful completion of the project, before relieving the PI.

13. Investigators must acknowledge the CERD in reports and technical/scientific papers published based on the research work done under the project. Investigators are requested to publish some of the research papers emerging out of the project work in leading Journals.

14. If the results of research are to be legally protected by way of patent/copy rights etc. the results should not be published without action being taken to secure legal protection for the research results.

15. The knowledge generated from the project will be the property of the CERD and should be properly acknowledged. Transfer of technology generated shall be done in consultation with the CERD.

We agree to the terms and conditions stated above. Please transfer the amount to the above bank account.

Signature of Principal Investigator:

Name:

Designation:

Signature of Head of Institution:

Name:

Office Address:

Seal

Annexure III

(Stamp paper Rs 200)

MEMORANDUM OF UNDERSTANDING [MOU]

BETWEEN

-Name of Self Financing Engineering College-

AND

APJ Abdul Kalam Technological University (KTU), THIRUVANANTHAPURAM

This Memorandum of Understanding is entered into at Thiruvananthapuram on this --- Day of Month Year

BETWEEN

-Name of Self Financing Engineering College- affiliated to APJ Abdul Kalam Technological University (herein after referred to as COLLEGE) which expression shall unless it be repugnant to the context or meaning thereof to be deemed to mean and include its successors and assigns, represented by The Principal, ---Name of college- place of college -, of the ONE PART.

AND

APJ Abdul Kalam Technological University, CET campus, Thiruvananthapuram-695016 (herein after referred to as KTU) which expression shall, unless it be repugnant to or inconsistent with subject or context thereof, include and be deemed to include their heirs, successors and assigns, represented by The Dean (Research), APJ Abdul Kalam Technological University, Thiruvananthapuram 695016 of the OTHER PART.

1. TERMS OF UNDERSTANDING

1.1. This memorandum of understanding lists out the terms of releasing and utilization of CERD research seed money fund sanctioned to a faculty of COLLEGE for the year ----------.

1.2. The scheme is constituted for the purpose of providing assistance in the form of grants to initiate research work in Engineering and Technology with particular relevance to the State of Kerala in the economic and industrial development.

1.3. Grant will be released to the principal investigator of the project through the Head of the institution.

1.4. The maximum duration of the project will be three years from the date of start of the project

1.5. On completion of the project, one copy of the final project report on the work done should be sent to the CERD along with the utilization certificate (UC) and statement of expenditure (SE).

1.6. The institute will maintain separate audited accounts for the project.

1.7. The institute will not entrust the implementation of the work for which the grant is being sanctioned to another institution nor will it divert the grant receipts to other institute as assistance.

1.8. The CERD reserves the right to terminate the project at any stage if it is convinced that the grant has not been properly utilized or appropriate progress is not being made. In addition, the CERD may designate a Scientist/Specialist or an Expert Panel to review the work done.

1.9. If the PI to whom the project has been sanctioned leaves the Institution, the Head of Institution/PI will inform the same to the CERD and in consultation with the CERD, evolve steps to ensure successful completion of the project, before relieving the PI.

1.10. Investigators must acknowledge the CERD in reports and technical/scientific papers published based on the research work done under the project. Investigators are requested to publish some of the research papers emerging out of the project work in leading journals.

1. 11. If the results of research are to be legally protected by way of patent/copy rights etc. the results should not be published without action being taken to secure legal protection for the research results.

1.12. The knowledge generated from the project will be the property of the CERD and should be properly acknowledged. Transfer of technology generated shall be done in consultation with the CERD.

1.13. For Private self financing Colleges, 50% of the actual Equipment cost subjected to the maximum of sanctioned amount will be reimbursed by KTU if and only if the proof of remittance of other 50% is produced by the COLLEGE.

1.14. The equipment details must be entered in the stock register of the college and signed by the Investigator, Lab in charge and Principal.

1.15. The college should submit annually the status and details of earlier grants received from KTU with pending statement if any.

1.16. The grant amount should be deposited in a separate bank account in the name of the Principal investigator and Head of Institution jointly.

1.17. The interest accrued shall also be accounted in the project.

1.18. If the project is not completed within the time limit, the grant amount should be reimbursed along with interest accrued.

We agree to the terms and conditions stated above.

2. SCOPE OF MOU

Nothing in this Memorandum is intended to or shall be deemed to establish an exclusive relationship between the parties or to restrict any activities that either party would otherwise be able to undertake. Nothing in this Memorandum is intended to or shall be deemed to establish any partnership or joint venture between the parties or constitute any activities that either party would otherwise be able to undertake.

3. PERIOD

This MOU shall be perpetual. This agreement will be amended or modified by the University at any time.

4. DISPUTE RESOLUTION AND ARBITRATION

This memorandum of understanding shall be governed by the laws of Union of India and State of Kerala. Any dispute arising with this MOU shall be brought to the notice of the Vice-chancellors of the parties who shall try to resolve them, failing which legal reasoning be taken in the jurisdiction of court in Thiruvananthapuram.

The terms and conditions of this memorandum of understanding shall not be disclosed to any third parties by any party of this memorandum of understanding without the prior written consent of both parties.

5. FORCE MAJEURE

Without prejudice to accrued liabilities and rights, no party shall have any liability whatsoever to the other Party or be deemed to be in default by reason of delay or failure in performance under this memorandum of understanding to the extent that such delay or failure is caused by or arises from acts or circumstance or events beyond the reasonable control of that party, including but not limited to acts of god, acts or regulations of any governmental authority, war or national emergency, accident, fire, riot, strikes, lock-outs, industrial disputes, natural catastrophes or epidemics.

Each Party shall bear its own losses arising from such force majeure event(s), if any.

6. INTELLECTUAL PROPERTY

All prior information, design and data existing with either party before the signing of this MoU (pre-existing IP) shall be the sole property of the concerned party. All Intellectual Property including design information, designs, source codes and data generated through the collaboration under this MOU shall be as mutually agreed in writing and also as per the guide line of the funding agency, if such an agency is involved. Any IPR arising specifically out of this collaboration will be owned by both parties, except when mutually agreed in writing otherwise.

IN WITNESS WHEREOF, the parties hereto have caused this memorandum of understanding to be executed in duplicate, through their representatives at Thiruvananthapuram in the day and year first above written:

Now the memorandum of understanding witnesses as follows.

Principal **Name of College** **University** **Place**	**Dean (Research)** **APJ Abdul Kalam Technological** **Thiruvananthapuram 695016**
Witness: 1	**Witness: 1**
Signature :	Signature :
Name :	Name :
Witness: 2	**Witness: 2**
Signature :	Signature :

SCMS School of Engineering and Technology

Sl.No	Name of Principal Investigator	Branch	Title of the Project	Amount sanctioned	First Installment	Second Installment	Consumables	Equipments	Travel	Contingency
1	VINOJ P G Assistant Professor	ECE	Brain Actuated Assistive Technology for the paralyzed	75,000	50,000	25,000	15,000	40,000	10,000	10,000
2	Y K Remya Assistant Professor	Civil	Geometric design consistency evaluation criteria for two lane rural combined curves	1,20,000	60,000	60,000	55,000		5000	60,000
3	Susmi Jacob Assistant Professor	CSE	ContextAuth – An implicit Authentication system for Smartphones	75,000	55,000	20,000	20,000	50,000		5,000

A SWARM BASED AI AIDED WHEEL BOT SYSTEM TO DETECT CRACKS IN RAILWAY TRACKS

INTRODUCTION

Indian Railway is one of the largest transportation networks in the world. It has a daily passenger count of 24 million passengers.For such a vast network the possibilities of lapses in safety is alarmingly high.

One of the major causes of hazard would be disruption in locomotive movement. Cracks in railway tracks have been identified as one of the major causes of railway accidents.Currently there isn't a fail proof system to detect and fix cracks on railway tracks. The system still follows the primitive methods of manual checking and solving.The project focuses on providing a real-time solution to the identified cracks on railway tracks. Once identifying a crack as a threat the agent aims at alerting the nearby agents as well as a base station by an active communication channel that updates the status in real-time. The projects implements a wheel-bot (UGV) which is able to differentiate between cracks and intentional gaps(thermal expansion). The Robots Dynamically communicate with other agents (Swarm Robotics approach) and the main workstation to relay information regarding the problems

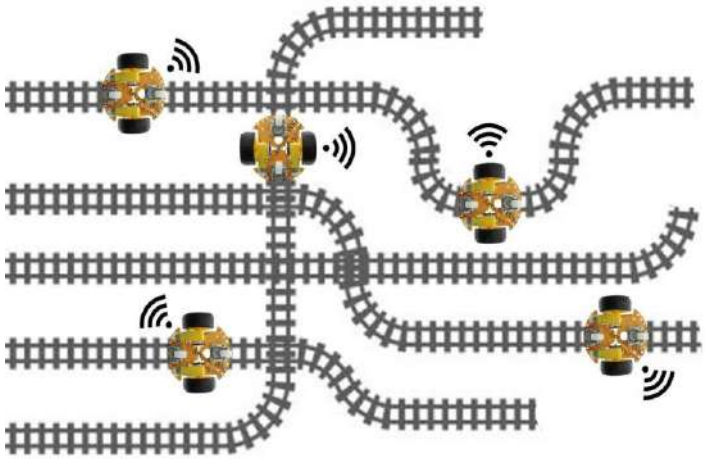
identified.Once the agent has identified a crack, it is intimated to the nearest base station for the track engineer to address the issue at the earliest.It also communicates to its nearest agents and alerts them regarding the identified setback. The system also tries to provide a safe environment for the locomotive system in the regions of animal crossing.

BACKGROUND AND MOTIVATION

Railway is the most essential form of transport in India, as it provides long-distance, comfortable travel within a budget for a commoner. According to the NCRB Annual Report 2020, there were 27,987 train accidents in 2019, 13,018 in 2020. The report also revealed that as many as 11,986 railway passengers were killed and 11,127 were injured in these accidents during the past year of 2021. Accidents like these can happen to various reasons, one of the most prominent being the cracks in railway tracks. The very concept of the project lies within identifying the type of cracks on the tracks. They are of two types, one being the intentional gaps left on the tracks for thermal expansion during summer. The other being the faulty cracks which can cause a catastrophe as dangerous as derailment of the train of the tracks. The current system lacks any kind of novel technology to identify and rectify faulty cracks. This project tries to work on this problem and provide a real time solution. The project also takes the vast scale of the domain into consideration. So it tries to provide a solution that requires minimal human interference and mobile management.

METHODOLOGY

The system is divided into clusters. Each cluster has a base station and a fixed number of agents. These agents follow swarm robotic architecture. The agents are deployed on the tracks. The number of agents in a cluster is determined by the maximum communication range of an NRF module which is the communication unit used in the product. The aforementioned can be extended up to 3 km. The cluster also has a fixed number of free robots that replace the working agents in case of a fault or low battery. The designed UGV is a four-wheeled bot that is deployed directly onto the railway tracks.

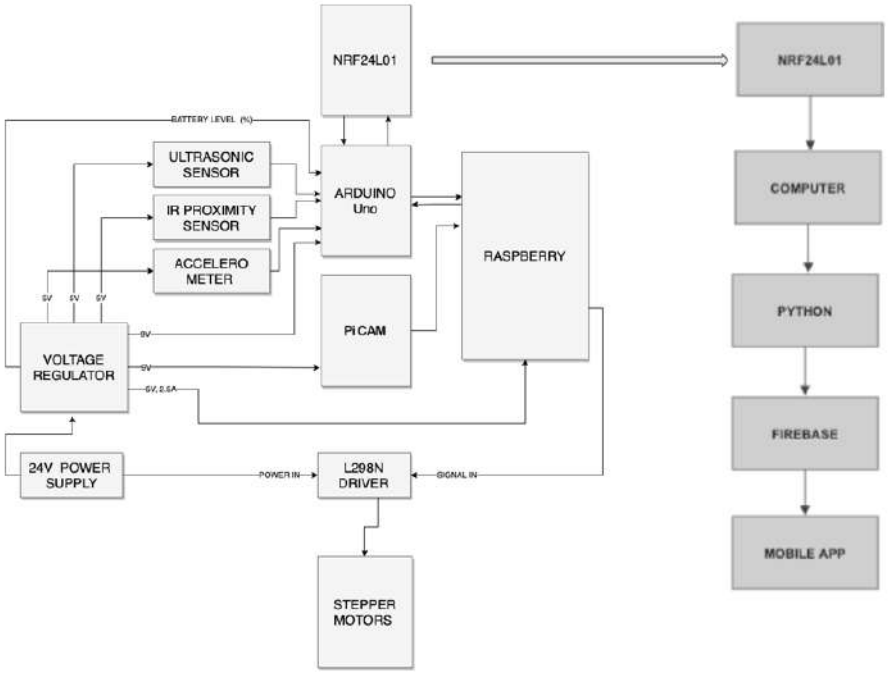


SYSTEM ARCHITECTURE

The system mainly comprises the communication unit and the sensor data processing unit. Communication is responsible for the efficient exchange of data between the agents as well as the base station. The agents communicate to the nearest bots and base station in the case of any kind of hindrance identified by the sensor data processing unit.
The sensor data processing unit is responsible for the detection of different types of cracks, obstacles, and faults in the agent itself. Various sensors are integrated and implemented for fault detection. The data is fed to the Arduino board which handles the communication and sensor data processing tasks.

The raspberry module is integrated in the system for image processing. The project aims toward efficient animal crossing detection which is common on the Indian railway tracks due to the terrains it passes through. The agents will be equipped with an FPV camera, which captures images when it encounters live object detection. Then running efficient image processing algorithms it identifies the subject in front of it and starts over only when the path is clear.

The model is also equipped with a GPS module which helps 7the other agents know its current location when it sends out data in case of fault detection. This helps other agents to reach that specific location and aid it. It also helps the base station to know the location of the fault.



COMMUNICATION UNIT

The communication unit is set up primarily using an NRF24L01 module. The inter-system communication happens in the case of:

- Crack detection
- Obstacle detection
- Animal crossing detection
- Agent failure

On the onset of any of the aforementioned conditions,the agent sends its location, proximity, X-Y coordinate values of accelerometer, IR proximity, temperature values to the assigned base station and nearby agents within communication range. A single RF channel with multiple communication pipelines is established with a dedicated pipeline for each of the agents. The agents constantly send data to their respective cluster base station which can be

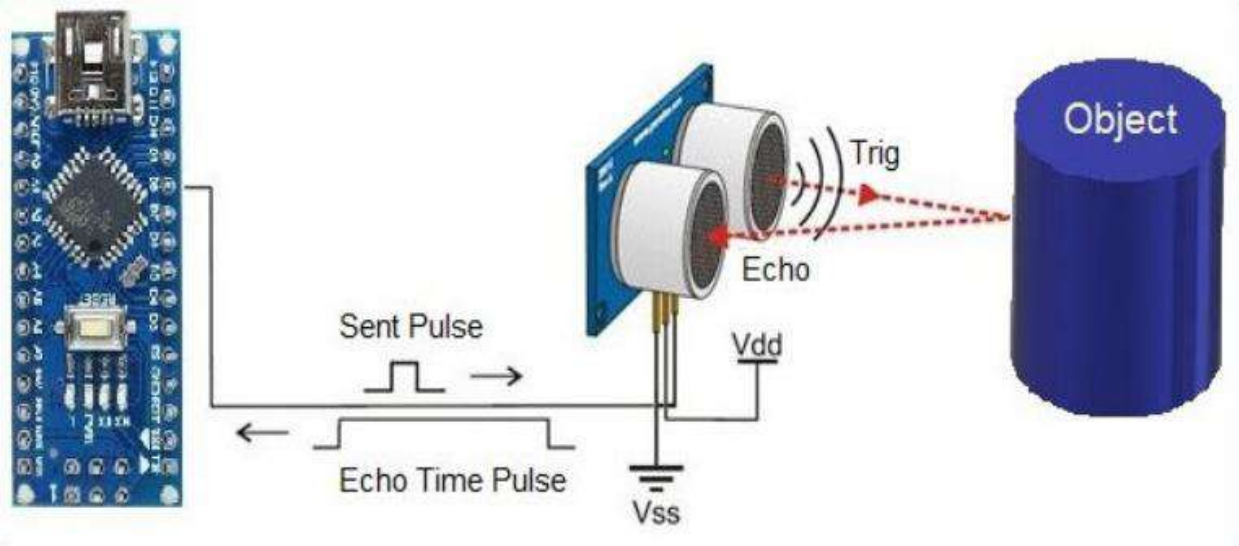
viewed on the android application. It shows a warning signal along with a trigger alarm when an agent detects an anomaly. It also communicates to the nearby agents when an anomaly occurs. A single agent can communicate up-to 6 agents at a time and has a maximum communication range of 3 km.

SENSOR AND PROCESSING UNIT

The sensor unit mainly comprises:

- Ultrasonic sensor (Obstacle detection)
- IR Proximity sensor (Crack detection)
- MPU6050 (Fault detection)

The ultrasonic sensor mounted in front of the agent continuously sends trigger pulses in front of it till certain proximity. In case of occurrence of an obstacle, it receives an echo back, meaning the pulse has hit a physical object and the agent confirms detection of an obstacle on the track.



ANDROID APPLICATION

An Android application is developed to alert the officials and the concerned individuals regarding the emergency condition that has to be addressed fast. The developed app gives the provision to know the different values of the sensors which include an IR sensor, a combined sensor module of Temperature and Accelerometer called MPU 6050, and a GPS module. The app gives an alert alarm and a warning image as the sudden response to cracks or any other obstacle encountered by the bot during their routine crack detection checkup. It consists of a parallel display providing a side-by-side view of the status of each bot. The app also consists of the two buttons named BOT_1 and BOT_2 which once clicked will lead to the live location of the robot where they are present. The approximate distance between the two robots will be displayed between the two buttons. This app is basically an interface that helps the authorities to know when to start the accident prevention steps. Basically, this app provides full-fledged access to know all the details regarding the robot including their nearest distance. The alarm system in the application causes a sudden alert throughout and constantly rings until an immediate step is taken. This app will be provided only to the Railway Authority officers as there are high chances of this app getting misused. The distance between the coordinates namely Latitude and the Longitudes are calculated using the Haversine formula. When one robot is getting tampered with or derailed, then the nearest robot will come to assist the damaged robot. The nearest distance is hence calculated with the help of the haversine formula.

ANIMAL DETECTION UNIT

The pathways of the crack detection robots are medalled with a plethora of obstacles and dangers. The bot actively responds against non-living obstacles using its array of proximity sensors. The next challenge are the living obstacles and dangers caused in specific locations like animal crossings and wildlife sensitive areas. Elephant crossings along various railway tracks can cause untimely disruptions in the proper movement of the robot. An efficient way to tackle this problem is a real-time animal detection system that takes in live camera feed and detects elephant crossings present in the frame. On the detection of an elephant the robot is signaled to halt its movement and wait for a safer environment to continue its movement by analyzing the live camera feed. The process of animal detection is carried out on a Raspberry Pi module attached onto the robot. Upon detection the Raspberry Pi is programmed to provide a motor signal to the required L298N motor driver module. Detecting an object entails both stating that an object belonging to a specified class is present, and localizing it in the image. The location of an object is typically represented by a bounding box.

RESULTS AND DISCUSSION

The prototype was successfully run on the simulated railway tracks and the results suggest that the final model can be successfully run on the actual railway track along with the implementation of auto-detachment feature from the track feature. The trains will be set up with proximity sensors and using the geo-location of the trains, when the train is within a proximity threshold distance, the agent proceeds to detach itself off the tracks onto the surface of the tracks. The agent uses actuators to lift itself off the track, then scissor hinges flips the wheels inside the tracks and the actuator proceeds to rest the agent onto the base of the tracks. The agent then lifts back up and places itself back onto the track when the train leaves the proximity threshold region.

The integration of the Indian railway database with the model can make the project extendable across the railway network of the country. With access to geo-location of trains and the thermal expansion tracks along with the train timings and delays, the efficiency of the model can be increased exponentially.

The success of the whole project revolves around the auto-detachment feature. A number of alternatives were brainstormed and discussed out, from the spider-bot model to linear actuators stand alone. After extensive research, cross-hinges along with linear actuators

along the wheels was confirmed to be the most feasible and suitable model for our project. This made sure there was an equal distribution of weight throughout the base of the robot. It also ensured a sturdy, fool-proof and hasty mechanism.

The inclusion of animal detection, arose from the obstacle detection module, when the presence of animal crossing was taken into consideration. When the obstacle detection module was being implemented, it was realized, the agent has to be cautious about not just the static, but the dynamic(animals) obstacles which may hinder the movement of robot on the track. Thus, the concept of image processing was brought up, which will help the agent identify if any kind of animal crossing is going on, on the tracks in front of it. Based on the type of animal crossing and the behaviour the animal exhibits, the robot can accordingly decide the amount of time it has to halt, before restarting its movement.

HIGHLIGHTS

This project consist of many features which enhances the credibility and use of the system. An application that supports the real-time data transfer and an alarm system is added to the app. As a next step to future implementations we have included an advanced feature of image processing. The app which is mentioned above consist of certain features which include an alarm and specific values of the corresponding cracks and defects which are found on the rail. Each feature contains a specific threshold beyond which the alarm starts to beep and a warning message will be popping up. Image Processing section will be dealing with the objects encountered by the bot. The proposed system is a swarm system and supports multiple bots and any damaged or derailed robot will be supported by the neighboring robot.

File Ref.No.KTU/RESEARCH5/467/2022

APJ Abdul Kalam Technological University
Thiruvananthapuram

Abstract

APJAKTU - Financial Assistance to Student Projects 2022 - Administrative Sanction accorded - Orders issued.

RESEARCH SECTION

U.O.No. 964/2022/KTU Thiruvananthapuram, Dated: 27.04.2022

Read:-1. Minutes of the 1st meeting of Engineering Research Council dated 27.01.2010.

2. Minutes of 2nd meeting of Executive Committee dated 21.10.2010.
3. Meeting of the 2nd Research Council dated 29.02.2017.
4. Proposals of Student Projects for Financial Assistance.
5. Screening Committee meeting held on March/April 2022 for evaluation of project proposals.

ORDER

Vide paper read 1st above, the Engineering Research Council had approved the scheme for Financial Assistance to Student Projects for the Government Engineering Colleges. Vide paper read 2nd above, it was decided to extend the financial assistance to the student projects to the students of the Government aided and Government Controlled Engineering Colleges.

It was decided to extend the financial assistance to Student Projects for all engineering colleges affiliated to the University with NBA accreditation as per paper read 3rd above. It was also decided that the financial assistance will be provided as reimbursement of expenditure occurred for the sanctioned project.

The Screening Committee meetings held in March/April 2022 evaluated the project proposals forwarded from Engineering Colleges affiliated to the University and recommended financial assistance to selected proposals as per the List appended.

Administrative sanction is therefore accorded for financial assistance to student project as detailed in the list attached below. The project shall be completed within a period of 1 year and the project shall be completed with the students who presented the project before the Screening Committee.

The expenditure should be incurred as per the terms and conditions as per Annexure II attached. The amount will be reimbursed to the Principal of the concerned Colleges only after the successful completion of the project and on the production of certified bills & vouchers along with the audited utilization certificate, statement of expenditure and project completion report.

The expenditure shall be met from the Head of Account “S 3022-Innovative Student Project”.

Orders are issued accordingly.

Sd/-

Dr. Shalij P.R *
DEAN (Research)

Copy to:-

1. Principals of Engineering Colleges.
2. Principal Investigators.

* This is a computer system (Digital File) generated letter. Hence there is no need for a physical signature.

LIST of Selected STUDENT PROJECT 2021-22

Sl No	Name of Princpal Investigator	Name of Student Investigators	Title of the Project	College	Consumables	Equipments	Travel	Contingency	Others	Amount sanctioned	DEPARTMENT
1	Lalu V Assistant Professor	Aparna E Divya G Meera S M Harinl	Automated Vacuun Cleaner	College of Engineering Trivandrum	2000	15,000		1000		18,000	ECE
2	Sindhu N Associate Professor	Abhirami G S Lasitha E Rigzin Dolma Sezna Bijumon	Negative emotion alert system	College of Engineering Trivandrum	3500	6000		2500		12,000	ECE
3	Jisha VR Associate Professor	Ashna Nizam Aysha S Hasna M Rafi Rosemary Mathew	Design and development of a pond cleaning robot	College of Engineering Trivandrum	5000	27,500	1000	1000		34,500	EEE
4	Yashida Nadir Associate Professor	Swaliha PC Vybhav A Nambiar Vishnupriya ES Shehina SS	Tensile,Bond strength properties of FRCM,AND ITS Strengthening effects on Structural Elements	College of Engineering Trivandrum.	8000	21,500	1000	4000 (Labour charges (5500))		40,000	CIVIL
5	Lea Mathew Associate Professor	Govind Jayakumar Abhirami P Aswana B Saurav Purushothaman	Prevalence of microplastics in table salt, sea water and beach sands of Trivandrum city	College of Engineering Trivandrum.	7000	25,000	2500	3800		38,300	CIVIL
6	Sidharthan S Assistant Professor	Abin Krishna V S Cherian G Kazhunnady Davis James Girinath P A	Design and development of an automated system for assisting agriculture	RIT Kottayam	10,000	30,000		10,000		50,000	MECH
7	Dr. Upama Rajan M N Assistant Professor	Aparna A Ajith Jayan Ashly C. Dhanu Sidharth S	IOT based SMART IRRIGATION SYSTEM	RIT Kottayam	5000	15,000		2000		22,000	ECE
8	Dr. Manu V Thottakkad Assistant Professor	Abhijith P V Chithran K S	Property Evaluation of Nano Grease Produced from Vegetable Oil	Government Engineering College Kozhikode	10,000	20,000	5000	15,000		50,000	MECH
9	Sreejith S Assistant Professor	Akshay Dinesh Harshad T Anaz Moideen Sivadas Athulraj V K	Agribot(Agriculture Robot)	Government Engineering College Kozhikode	5000	7000		1000		13,000	ECE
10	Dr. Bindima T Assistant Professor Co-Investigator Titto Anujan Assistant Professor	P V Vivek Kumar Hithesh Kumar K.A K Yadukrishnan Melvin Manuval Alestin Chummar	Gesture - controlled Augmentative and Alternative Communication Device	Government Engineering College Kozhikode	5000	10,000		2000		17,000	ECE
11	Dr. Abdu Rahman V Assistant Professor	Megha T P Reshma N Merin Thresia T Shilpa Unni	IoT based public vehicle tracking system	Government Engineering College Kozhikode	5000	7000		1000 (Expenses for fabrication of the prototype-1000)		14,000	ECE
12	Jinu Jayachandran Assistant Professor	Aslam E K Asif Sartaj Mohammed Adil Ashraf Mohammed rameesh CV	Smart Class room	GEC Wayanad		6500	500	500		7500	ECE

13	Prof. Anas.M Assistant Professor	Arya Suresh Nithu Raveendran Jesin Vengilatt Muhammed Shahid .K	Underwater Drone	Government Engineering College Wayanad	4000	20,000	2500	2500		29,000	ECE
14	Dr. Aji Joy Associate Professor	Sruthi G Panicker Ijaz E Ephraim Mathai	Design of a swam of drones for courier service.	Mar Athanasius College of Engineering, Kothamangalam,	5000	18,000		2500		25,500	ECE
15	Geethu James AssistantProfessor	Akshay Johnson C Amrutha Jerin George Munna Mani	Landslide detection and warning system	Mar Athanasius College of Engineering Kothamangalam	5000	25,000	2000	2000		34,000	EEE
16	Ninu Joy Assistant Professor	Abhishek Mohan Adwaith S Alfiya Subair Anto Jose	Performance analysis of a complete EV powerstrain using a microcontroller and Matlab simulink	Mar Athanasius College of Engineering Kothamangalam	1000	18,000	1000	1000		21,000	EEE
17	Dr. Elizabeth Isaac Assistant Professor	Anju C A Jesvin Varghese Labeeb E V	Wearable hand device for sign language prediction and audio output.	Mar Athanasius College of Engineering, Kothamangalam,	500	20,000				20,500	CSE
18	Mohamed Shahid P. A Assistant Professor	Sreekanth M. Midhun Murali Abhinand A. Nandu Mohan	DESIGN OF A 2 DOFS DRIVING MECHANISM FOR A MOTION ASSISTED FINGER EXOSKELETON	TKM College of Engineering,Kollam	10,000		5000	15,000		30,000	MECH
19	Jyothis R Assistant Professor	Vishnu B Vinod Abel S Varghese Divya T P Akshay Kannan	Robotic Doctor	TKM College of Engineering, Kollam	5000	25,000		3000		33,000	ECE
20	Shafi M N Assistant Professor	Vipin Krishna V Krishnanunny.S Rajasree.S Fathima A	Multipurpose Hybrid VTOL UAVs	TKM College of Engineering, Kollam	2000	30,000				32,000	ECE
21	Dr. Nissan Kunju Assistant Professor	Agilezuevy K.R Shravana A.J Shahina S Devapriya J.	Design and Implementation of a cost-effective portable Electrical neuromuscular Stimulator.	TKM College of Engineering, Kollam	2500	4500		500		7500	ECE
22	Prof. Amina N Assistant Professor	Anagha M Das Akhila Raveendran Mohammed Jaris J Neethu K	IoT empowered smart farming	TKM College of Engineering,Kollam-		6000		1000		7000	ECE
23	Dr. Mathew P Abraham Assistant Professor	Bharat Vinod Binitha Merlin Philip Emil Roy Navami Dilee	Design and Development of Inverted Pendulum Balancing Drone	TKM College of Engineering, Karicode	1000	40,000	1000	2500		44,500	EEE
24	Dr. Mohammed Mansoor O Assistant Professor	Anandu Ajayan Ajay Babu Anilbabu Athul Krishnan Nevin Binu	Low Cost Electronically Commutated Mixer Grinder	TKM College of Engineering, Karicode	3000	32,000	2000	3000		40,000	EEE
25	Dr. Priya K. L Assistant Professor	Gayathri H Gowtham Mohan Gopika Sankar M S Sreelekshmi S	Tidal and physico-chemical effects on the distribution of chlorophyll-a in the Ashtamudi estuary, India and Chikugo estuary, Japan	TKM College of Engineering Kollam	10,000	25,000	10,000	5,000		50,000	CIVIL
26	Dr. Priya K. L Assistant Professor	Abhijith R Nair Abhinand A S Vikhnesh C R Vishnu Raj	A coupled RSGIS-Fuzzy Logic Model for Evaluation of Eutrophication Status of Freshwater Lakes	TKM College of Engineering Kollam	10,000	30,000	5000	5000		50,000	CIVIL

27	Femina A Associate Professor	Ansi AS Devipriya Mudiyil Hina Mol Yadu Krishnan V	Removal of Heavy Metal from Water using Agro-waste	TKM College of Engineering, Kollam.	3000	10,000	1000	1000 (10,000/- for analysis)		25,000	CHEMICAL/BIOTECH
28	Dr.Habeeb Muhammed MA Assistant Professor	Anitha Jose Joseph Martin Parvathy Santhosh Bhadran Vishnu Sahadev	Fabrication of NIR luminescent gols nanocluster NIR Plasmonic Copper Sulphide nanoparticle hybrid for bioapplications	TKM College of Engineering Kollam	10,000	33,000	2000	5000		50,000	CHEMICAL/BIOTECH
29	Prof. Nikhil Binoy C Associate Professor	Sreeja Balaji Vismaya K Jinsha C	Detection of Pipeline Crack and Clog detection Robot using Convolutional Neural Network.	NSS College of Engineering NSS Nagar, Akathethara, Palakkad.	2000	5000		500		7500	ECE
30	KEERTHI KRISHNAN K Assistant Professor	Abhishek.A Govind Vijayan Vishnu Nismi PT	Smart Assistance Glove with Gesture Recognition.	NSS College of Engineering NSS Nagar, Akathethara, Palakkad	2500	3500		1500		7500	ECE
31	Dr.MayaMohan AssociateProfessorand Head	AmalRosh AnolJoseph C Vyshanv Prasanth SouravMenon	Intrusion Detection in Home loT Network Using Deep Learning.	NSS College of Engineering NSS Nagar, Akathethara, Palakkad,	3400	13,800		1500		18,700	CSE
32	Soja Salim Assistant Professor	S Aravind P Lakshmi Sara Sulthana Shaji	Satellite Imagery to map translation	SCT College of Engineering, Pappanamcode				5000		5000	CSE
33	Dr. Soniya B Professor	Sukanya M V Arun T Jose Aarcha J R	Multimodal FakeNews Detection using hybrid RNN-CNN approach	SCT College of Engineering. Pappanamcode		50000 (for purchase of GPU)				50,000	CSE
34	Biju Jacob Assistant Professor	Albin L Vinod Aswathy p Chandran Manya Madhu.B Naveen Antony	Comparitive Study of Methods for restoration of biological soil crust in ecosystems disturbed by excessive surface runoff	Sree Chitra Thirunal College of Engineering Pappanamcode	10,000	30,000	2000	5000		47,000	CHEMICAL/BIOTECH
35	Smt Gayathri V Assistant Professor	Devi Krishna Diya Sharma Jeswin Elizabeth James Navaneeth Subash	Comparitive Study of biohydregen Production in Microalgae and bacteria through fermentation process	Sree Chitra Thirunal College of Engineering Pappanamcode	10,000	30,000	2000	5000		47,000	CHEMICAL/BIOTECH
36	Biju Jacob Assistant Professor	Anslet Mary Abhinav Anil Anupama SS V Reshmi	Analysis and Optimisation of Process Parametres for Improving the Self Healing Capacity of Immobilized Bacteria Based Concreate	Sree Chitra Thirunal College of Engineering Pappanamcode	9960	29,000	2000	5000		45,960	CHEMICAL/BIOTECH
37	Venkitaraj K P Assistant Professor	Aneesh A Arun B Aswathy Elizabeth Jacob Aswathy Ramesh	Thermal Management of Photovoltaic Cell using PCM FOR Improved Efficiency and Power Output	College of Engineering Adoor	10,000	33,000	2000	5000		50,000	MECH
38	Deebu U S Assistant Professor	Aanand R Bhatt Ananthu Krishnan Arjun C O Shifas Shajahan	Smart door system with COVID-19 risk factor evaluation, contactless data acquisition and sanitization.	College of Engineering, Adoor	2000	12,000		2000		16,000	ECE

39	V. Praseeda Lekshmi Professor	Keerthi Nair Sangeetha.B Aditya Anoop Harikrishnan G	Traffic Surveillance System and Criminal detection using image Processing and deep Learning	College of Engineering Perumon	5000	15,000		1000		21,000	ECE
40	Archa A.B Assistant Professor	Anagha Jyotish Fathima.M Gayathry.S Sangeetha Santhosh	Foresight for visually impaired people.	College of Engineering Perumon	4000	8000		1000		13,000	ECE
41	Saritha M Assistant Professor	Vivek VS Sabari S Asan John Britto Karthik S	Water Cleaning Vaccum Pump and Quality	College of Engineering Perumon	5000	15,000	2000	2000		24,000	EEE
42	Rajesh.MS Assistant Professor	Sanjith.S Nimmy John Gowri Menon B Abhijith	Automatic Floor Cleaning Sanitizing Robot	College of Engineering Chengannur	5000	7500		1500		14,000	ECE
43	Dr. Sarah Jacob Associate Professor	Vishal B Nayana Girish Shamnad S	Pill Dispenser	College of Engineering Chengannur	5000	10,000		2500		17,500	ECE
44	Deepa J Professor	Abhishek P B Adithya Anil Anjali Balakrishnan Athena Anna Sabu	Wild Elephant Intrusion Detection System using Image Processing Techniques	College of Engineering Chengannur	2500	8000	1000	1000		12,500	ECE
45	Sherin Joseph Assistant Professor	Adithya Ahalya A Kumar Amrutha Mohan Shravan Sa	Smart cap for visually impaired	College of Engineering Chengannur	1000	11,000	1000	2000 (Rs. 1000/- for Research literature)		16,000	EEE
46	Rakesh R J Assistant Professor	Ajith Krishna S A Bona Das Vijaya Lekshmi M V Gokul Krishna V S	Smart Aqaponics System	College of Engineering Muttathara	600	8980		4500		14,080	CSE
47	Joby James Assistant Professor	Abhijith S Adarsh S Syam Saseendran	Detecting buried human bodies using ground penetrating radar in FPGA.	College of Engineering, Kidangoor	2500	4500		1000		8000	ECE
48	ASWATHY N ASSISTANT PROFESSOR	AISHA MEHRIN K I ASWANI M RAVI AUSHIN JOSE MANJOORAN FARHAN NAJEEB FINTO SHAJAN	MED-MATE	Adishankara Institute of Engineering and Technology ASI	5000	6000		1000		12,000	ECE

49	Abi Varghese Assistant Professor	Abhishek Prasad Albin Alex Uzhuvathu Ananthu Ramesh Ansan P Sam	Ergonomic modification and bio-mechanical analysis of the rubber tapping knife (michie golledege knife) for improving body posture of rubber tapper	Amal Jyothi College of Engineering, Kanjirappally	10,000	25,000	2500	5000		42,500	MECH
50	Abubeker K M Assistant Professor CoInvestigator K.G Satheesh Kumar Professor and HoD	Abey Joshy Arunima Tressa George G Gopika	Hardware and Open Source Software Deployment for Real-Time Monitoring of Hyperglycemia and Hypoglycemia Using Non-Invasive Biosensors and Machine Learning approaches.	Amal Jyothi College of Engineering Kanjirapally	5000	15,000		2000		22,000	ECE
51	Dr. S. N. Kumar Assistant Professor	Alen J James Andrew Dixen Naamah Susan Saji Riya Thomas	Portable Embedded System for Stress measurement- An aid for Human Health Care	Amal Jyothi College of Engineering Kanjirappally, Kottayam	1000	6000	1000	2000		10,000	EEE
52	Dr. Nimi Ann Vincent Assistant Professor CoInvestigator Anaswara S Assistant Professor	Neethu S Jomol Mariam Joseph Thomas P Joseph Roja S Emmanuel	A preliminary experimental study of mitigating coastal sand dune erosion by microbially induced carbonate precipitation (micp) using laboratory microcosm.	Amal Jyothi College of Engineering Kanjirapally	6000	15,000	4000	3000		28,000	CIVIL
53	Dr.Vishnu.M Assistant Professor	Digin Tense Jubin Biju Thomas Sreelakshmi NV Sruthy Jayasankar	Biodegradable Chitosan-Based Film for Food Packaging	Amal Jyothi College of Engineering Kanjirappally	5000	15,000	2000	5000		27,000	CHEMICAL/BIOTECH
54	Dr.Vishnu.M Assistant Professor	Thomas J Kallupurakel Jithin Jacob	Microbial Oil from Wastewater	Amal Jyothi College of Engineering Kanjirappally	7000	15,000	2000	2000		26,000	CHEMICAL/BIOTECH
55	Dr. Biju C V Professor	Jobin C J Edwin Anto Amal Paulson Mariya Shobby	Development and testing of resonance free mechanical structures for enhanced stability in dynamic conditions	Jyothi Engineering College Thrissur	10,000	20,000	5000	10,000		45,000	MECH
56	Arun J S Assistant Professor	Miladh Muhammed S Vishnu P Kumar Joshin Samuel	ROS based autonomous hospital assistant robot	Mar Baselios College of Engineering and Technology, Trivandrum,	3500	20,000		2500		26,000	ECE
57	Dr. M J Jayashree Professor	Aswin Nandu A C Harikrishna Sharma Gokul G S Tushar Kumar	Gesture controlled stair climbing wheelchair	Mar Baselios College of Engineering and Technology, Trivandrum,	4000	20,000		2000		26,000	ECE
58	Dr.Jayakumari.J Professor	Jobin J, Mr.Rohith M, Mr.Visakh Neelakantan	Development of IOT based energy autonomous parking sensor device	Mar Baselios College of Engineering andTechnology, Trivandrum,	3000	10,000		2000		15,000	ECE
59	Sherin Mathew Assistant Professor	Abhiram S Madhu Anakha S Karthik Santhosh Sifa Raisa S H	Blind spot detectors at A- Pillars for Road Safety	Mar Baselios College of Engineering and Technology	2000	4250	1000	1000		8,250	CIVIL

60	Dr. M Satyakumar Professor	Bijin S Russel Merlin P K Sandra A L Visakh S R	Two wheeler curve detection and pollution warming systems	Mar Baselios College of Engineering and Technology	2600	4000	1300	1300		9,200	CIVIL
61	Sreeja.S R Assistant Professor	Aparna LS ChelsiaEapen Muthulakshmi S Paliyath S Aju	Surround Perception and Audio Directing Device	Mar Baselios College ofE ngineering and Technology, Trivandrum,	7000	18,750				25,750	CSE
62	Subha P S Associate Professor	Abhyshek R Srtutyhy Selvan Pereira Alka Gilbert D Sabarish	Braille printer	Marian Engineering College	5000		1000	2500		8500	ECE
63	Soorya SR Assistant Professor	Abdul Fayad Mohammed Yafi Shalima RS Ahmad Shiras Pooja Ajin	AUTOMATED WASTE SEGRAGATOR	Marian Engineering College Trivandrum	6500		2000	1500	10,000 (Additional expense for the specific work related to project)	20,000	CIVIL
64	Kannan K Assistant Professor	Aarcha MS Adarsh S Nair Ijas Ahamed Neha Felix	Effect of Geocell Reinforcement on Lateritic soils with Underground Void	Marian Engineering College Trivandrum	1200		4000	3000	37100(Additio nal Expenses for the specific work related to the projec)	46,300	CIVIL
65	Dr. Rittin Abraham Kurien Assistant Professor	Ashwin Santhosh Daniel Paul Gowrisankar B Kurup Greshma Susan Reji	Finite Element Analysis and Experimental Investigations on Natural Fiber Composites from Vetiver and Jute for Sustainable, Eco-friendly and Commercial Applications: Development, Mechanical and Morphological Property Estimation.	Saintgits College of Engineering	9950	25,000	4950	4970		44,870	MECH
66	Anu Raj Assistant Professor	Anju Sosa John Greeshma Thomas Sona Susan Zacharia	IoT based real time air & noise pollution alert system for asthma and angina patients.	Saintgits College of Engineering Kottayam	2000	7500		500		10,000	ECE
67	Harinarayanan Namboothiri M G Assistant Professor	Arjun K S Abhijith Arun Anpin Mary John Kevin Kallikunnil Varghese	Isolation Robot (ISO-BOT) for patient health care.	Saintgits College of Engineering Kottayam	5000	10,000		1000		16,000	ECE
68	Dr.N. Mahendran HOD	Abrar Ahmad Mallah Jerlin P Varghese Joenty Jose Mathew Philip	Hybrid Outdoor Lighting System using Gravitational Force	Saintgits College of Engineering Kottayam	1500	1750	1000	1000		5250	EEE

69	Dr. Rajesh Baby Associate Professor	Bilbin Mathew Paul Vargheson Alan Philip Rajan	Development of an automatic height adjusting pillow to relieve chronic neck pain (cervicalgia).	St. Joseph's College of Engineering and Technology Palai.	10,000	25,000	5000	5000		45,000	MECH
70	Ivin Jose Assistant Professor	Thimothy Benny Akhil Krishnan Genesis J Cheruvallil Benchamin Tomy	Tool design and fabrication of hybrid electro discharge grinding setup for microchannels	St. Joseph's College of Engineering and Technology Palai.	10,000	25,000	5000	10,000		50,000	MECH
71	Dr. Madhukumar S Professor	Prince Jose Vijay Varghese Amal Varghese Jubin Thomas	Borewell rescue robot	St. Joseph's College of Engineering & Technology Palai	5000	15,000		1500		21,500	ECE
72	Anto Manuel Assistant Professor	Adithya Sunil, Ben Alphin Binny, Jobin Benny Roshan Rajeev	An Intelligent Device To Predict Cloud Burst	St. Joseph's College of Engineering and Technology Palai.	5000	15,000		1500		21,500	ECE
73	Dr. Praseetha V M Associate Professor	Anjana V M Tinu Sam Rona Mariam Shaji Tressa Mary Joseph	Gesture based device controlling system	St. Joseph's College of Engineering and Technology Palai.	3000	11,500		1800		16,300	CSE
74	Dr.Georgina Binoy Joseph Associate Professor	Akshara Sajeevan Ann Mary Abraham Aswathy Meria Peter Honeymol M Jose	SMART MIRROR	Toc H Institute of Science and Technology	2000	10,000		1500		13,500	ECE
75	Girish.P Assistant Professor	Anagha Biju Betty George KP Manjulika Sneha Baby.KX	ACCI-LERT SYSTEM	Toc H Institute of Science and Technology	2000	8000		1500		11,500	ECE
76	Dr.Rosebell Paul Asst. Professor	Neeraj M Neeraj Sagar Vaibhav Nair Yadukrishnan PS	An AI Based Swarm Wheel fot system to detect Cracks in Railway Tracks.	SCMS School of Engineering and Technology, Ernakulum, KarukutY	8260	36,000		4,000		48,260	CSE
77	Harish T M Assistant Professor	Nandu Krishnan A U Nasmal Navas Sreekanth K.A	Development and fabrication of Al 7075 composite reinforced with industrial waste and clay	Federal Institute of Science ancl Technology, Ernakulam	10,000	10,000	5000	20,000		45,000	MECH
78	Manu Mohan C M Assistant Professor	Joheon C P Joseph Paul Linto Thomas Rajeev K R	Sign language to speech converter using machine design	Federal Institute of Science ancl Technology, Ernakulam	3500	10,000	500	2500		16,500	ECE
79	Sreevidya P Assistant Professor	Gokul Rejitkumar Godson Thomas	Integrated communication system for deaf and mute	Federal Institute of Science ancl Technology, Ernakulam	3000	10,000		1000		14,000	ECE
80	S Sundararajan Assistant Professor	Bilal Ibrahim P A Rajeena R Sony Shajan	Fruits adulteration detection system	Federal Institute of Science ancl Technology, Ernakulam	1500	5000		1000		7500	ECE
81	Panjami K Assistant Professor	Aleena Garvasis Apsara S Baiju Gayathri S Kumar Gokul S	Study on Effeetiveness of Mobile sensors in deteeting sutrsurface cavities- A step towards earlv detection of cavities at Kerala	Federal Institute of Science ancl Technology, Ernakulam	10,000		35,000	5000		50,000	CIVIL

82	Dr. Trijo Tharayil Associate Professor	Akhil A R Akhil Kumar K S Akhil Sankar Aswin Yesodharan	Thermal management of batteries in electric vehicles using pulsating heat pipe	Sree Buddha College of Engineering, Pattoor	10,000	25,000	5000	5000		45,000	MECH
83	SHAMNAMOL G K Asst. Professor	Ms. Sruthi J Nair Ms. Sredha J Nair	Bio-Synthesize of Zinc oxide Nanoparticles Using Banana Empty Fruit Bunch Extract for Corrosion Mitigation	Sree Buddha College of Engineering, Pattoor,	4630	7,433	3000	5000		20,063	CHEMICAL/BIOTECH
84	Dr. Shalini A Nair Associate Professor	Adithya.CV	Biosensing of stress Biomarkers	Mohandas College of Engineering and Technology	5000	10,000	1000	3000		19,000	CHEMICAL/BIOTECH
85	Vipin Vijayan Assistant Professor	GREGORY JAMES ABHINAV SYAM NANDU V NATARAJ PREJITH KUMAR P V	Value addition of banana pseudostem and fish scales in developing novel biocomposite for bone tissue engineered scaffold applications.	Muthoot Institute of Technology and Science, Ernakulam	9,950		4800	5000		19,750	MECH
86	Dr. Shoba Gopalakrishnan Associate Professor	Sreeram M Aleena Sara Varghese Sindhoora Harsha Daniel	Anti-drone Detection System.	Muthoot Institute of Technology & Science, Varikoli P.O., Ernakulam (MUT)	2000	5000		1000		8000	ECE
87	Dr. Chikku Abraham Vice Principal & Professor	Basil Saju Jones Mathew Cleetus Leo Benn Dominic Midhun Raj M	Investigation of a Novel Totem Pole Converter Using WBG Devices for On Board EV Chargers	Muthoot Institute of Technology and Science, Varikoli P.O	10,000	26,000	1000	4000		41,000	EEE
88	VenugopalanKurupath Associate Professor	Fadil Farooq Meenakshi S Riya Vinod Shabana M B	Development of Low Cost User Friendly Audiometric System	Muthoot Institute of Technology & Science Kochi-	5000	10,000	1000	3000		19,000	EEE
89	Dr Mary Lissy P N Associate Professor	Adithyan P S, Shefil C, S Afeeque, Thazneem A Saleem	Residential W energy system	Muthoot Institute of Technology & Science, Varikoli, Puthencruz-682308. College code: MUT	2750	9250	2000	2000		16,000	CIVIL
90	Nesihath MK Assistant Professor	Mohammed Fayis MV Kiran KM Adeeb Sameer Ahmed Ajsal UP	Smart Micro-grid Energy Management System Considering Vehicle to Grid Technology	MES College of Engineering Malappuram,MES	1000	18,000	1000	1000		21,000	EEE

Dean Research

Annexure II

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Terms & Conditions for Financial Assistance to Student Projects

1. The amount has to be utilized as per budget provision under each head.

2. The purchase of equipments shall be in accordance with the store purchase rules. All equipment purchased will be the property of the University and the stock entry of the items purchased shall be maintained in the College. Purchase of computers/peripherals is not allowed unless specifically mentioned in the sanction order.

3. The stock entries of consumables purchased shall also be done in the consumables stock register of College. Purchase of stationery shall be for project purpose only. Printing charges for multiple copies of the project report will not be admissible.

4. The maximum duration of the project is one year from the date of sanction. It is the discretion of the University to settle amount towards the purchase of those items not clearly mentioned, if any, in the project proposal.

5. On completion of the project, detailed report of the research work, audited statement of accounts Utilization Certificate and Expenditure Statement in the prescribed format duly attested by the head of the institution along with original bills towards expenditure incurred with payment certificate of the Principal Investigator shall be submitted within one month of completion of the project for reimbursement of expenditure. The Bank Account details of the Principal shall be submitted along with the request for reimbursement. Requests for reimbursement shall not be considered after the date of submission of documents as above.

6. For reimbursement of expenses under the head **Travel**, Train tickets/Bus tickets/Taxi receipts, in original, affixing payment certificate of the Principal Investigator specifying the purpose of travel with actual distance of journey and fare shall be submitted.

7. On all publications resulting from the finding of the research/project, due acknowledgement shall be given to the University.

8. Book or literature purchased, if any, should be taken into the Stock Register of Central Library or Department library and then distributed to the investigators.

9. The expenditure under the head **Others** is admissible as per the budget proposed. All other expenditure has to be included in the head Contingencies.

Title of Project

Signature of Principal Investigator:

Name:

Office address:

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CENTRE FOR ENGINEERING RESEARCH AND DEVELOPMENT
College of Engineering Trivandrum Campus
Thiruvananthapuram. Pin 695 016

Application format for Research Seed Money

1. Title of the Research Proposal: Brain Actuated Assistive Technology for the paralyzed

2. Name & address & experience of Investigator: VINOJ P.G,ASSISTANT PROFESSOR,ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT,SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY,VIDYANAGAR,PALISSERY,KARUKUTTY,ERNAKULAM-683576
MOBILE NUMBER:9446276238 EMAIL:vinojpg@scmsgroup.org
Experience: Teaching :10 years 4 months Industry: 2 years

3. Teaching experience: 10 years 4 months
Assistant Professor at SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY from 2-09-2010

4. Objectives (150 words):

- To develop a Brain-controlled assistive technology for the paralyzed
- To develop a low-cost, flexible and Light weight alternative for exoskeleton
- To control exoskeleton movements using human Intentions
- To automate the post-stroke rehabilitation and assistance using artificial Muscle Intelligence
- To develop communication aid for the paralyzed to express their feelings

5. Broad Subject area / field of classification
Brain Computer Interface (BCI), Medical Electronics/Assistive Technology

6. Project Type(s)
(Basic Research / Applied Research / Developmental / Demonstration / Others
Demonstration

7. **Abstract (400 words)**

Due to partial or full paralysis due to stroke, the majority of patients are compelled to rely upon parental figures and caregivers in residual life. With post-stroke rehabilitation, different types of assistive technologies have been proposed to offer developments to the influenced body parts of the incapacitated. In a large portion of these devices, the clients neither have control over the tasks nor can get feedback concerning the status of the exoskeleton. Brain Computer Interface (BCI) controlled assistive technology is the new paradigm, providing assistance and rehabilitation for the paralyzed. But, most of these devices are error prone and also hard to get continuous control because of the dynamic nature of the brain signals. Moreover, existing devices like exoskeletons bring additional burden on the patient and the caregivers and also results in mental fatigue and frustration. The proposed framework tackles these issues utilizing a Brain Actuated Assistive Technology for the Paralyzed (BAATP), in which the exoskeleton movements are controlled based on user intentions. The BAATP uses a flexible design which can be customized according to the

degree of disability. The BAATP system also automatically identifies the status of the paralyzed person and transmits information securely using Novel-T Symmetric Encryption Algorithm NTSA to caregivers in case of emergencies. The exoskeleton is fitted with actuators and motors which are controlled by the human intentions of the user with an Electroencephalogram (EEG) headset. The BCI interfaced micro-controller controls the high torque motors and actuators connected to the exoskeleton joints based on user intentions.To automate the rehabilitation process, Artificial Muscle Intelligence (AMI) is incorporated in the proposed system. AMI integrates user intentions with artificial muscle movements in an efficient way to improve the performance. Human thoughts captured using Electroencephalogram EEG sensors are transformed into body movements, by utilizing micro-controller and Transcutaneous Electrical Nerve Stimulation (TENS) device. EEG signals are subjected to pre-processing, feature extraction and classification, before being passed on to the affected body part. The system also provides a feature for communicating human intentions as an alert message to caregivers, in case of emergency situations. This is achieved by offline training of specific gesture and online gesture recognition algorithm. The recognized gesture is transformed into speech, thus enabling the paralyzed to express their feelings to relatives or friends. Experiments were carried out with the aid of healthy and paralyzed subjects. The AMI system can reduce mental fatigue, miss-operation, frustration, and provided continuous control. The thrust of lifting the exoskeleton is also reduced by using lightweight wireless electrodes. The proposed system will be a great communication aid for the paralyzed to express their thoughts and feelings with dear and near ones, thereby enhancing the quality of life.

8. Scientific scope of the Research proposal (400 words)

The recent survey by reeve foundation revealed the impact of paralysis on world population, affecting approximately 5.4 million people. The survey also identified stroke (33.7%) as the major cause for paralysis.Exoskeleton-assisted technologies have emerged as a reliable means for rehabilitation of the affected upper and lower limbs.Because of the dynamic and uncertain nature of brain signals, most of the BCI systems result in miss-operation, mental fatigue and it is hard to produce continuous control. The proposed system is designed to address the above gaps in research.The Brain Actuated Assistive Technology for the Paralyzed (BAATP) analyses the human thoughts and transforms it into different movements on a unique exoskeleton structure. The contributions of the research are,

1. A Brain Actuated Assistive Technology for the Paralyzed (BAATP), in which the exoskeleton movements are controlled based on user intentions.
2. An adaptive mechanism based on sensory feedback integrated with the exoskeleton to reduce the system false rate.
3. A flexible design for the exoskeleton which can be customized according to the degree of disability.
4. Automatic identification of the status of the paralyzed person and secure transmission of information to caregivers in case of emergencies
5. An Artificial Muscle Intelligence (AMI) system, in which adaptive mechanism based on recorded muscle movements is integrated with the system to enhance continuous control and facilitate rehabilitation.
6. Communication aid is incorporated in the system using gesture recognition

Methodology

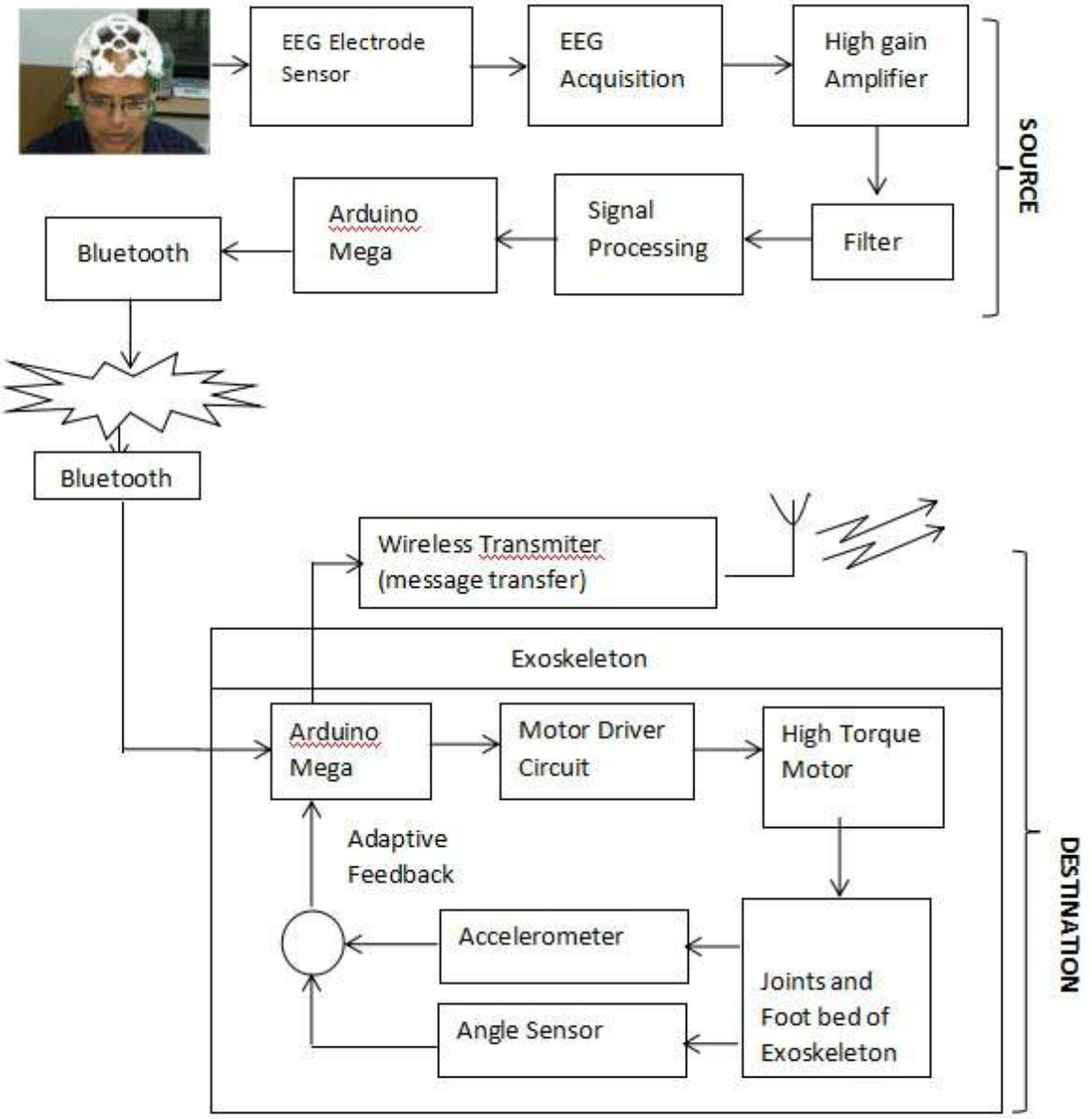


FIGURE 1. System architecture for Brain Actuated Multidimensional Exoskeleton

The architecture of the proposed system is presented in figure 1. The system design comprises an exoskeleton that replicates a lower limb, which is made using carbon fiber. The exoskeleton has total six degrees of freedom including both legs, one on each side of the pelvic bone, one on each knee and one on each ankle. Thus three degrees of freedom on each leg making it total of six degrees of freedom on the entire exoskeleton. Each joint of the lower limb is actuated using high torque motors. The movement of the exoskeleton is facilitated by controlling the degree of rotation of the motors. This exoskeleton is strapped onto the abdomen as well as foot region for improving the stability and balance of the person. Support is also provided on the back side of the ankle region. The angle sensors are placed on the joints to provide feedback regarding the status of exoskeleton. This sensor is also used to validate whether the applied force is sufficient to stabilize the

exoskeleton. The fall detection mechanism is implemented by placing an accelerometer on the back side of the lower limb to measure the tilt. If the measured sensor value crosses the threshold, a message will be given to the caregivers for emergency rescue.

The exoskeleton is controlled through human intentions. Electroencephalograph (EEG) sensors use non-invasive methods to collect the brain signals from the scalp of the person. EEG sensor has 16 electrodes incorporated in structure, where two electrodes act as the reference for measurement. The conductivity of the electrodes is improved by using gold plating. The signals collected are amplified using a high gain amplifier and a band pass filter is used for filtering high-frequency noise. In the signal processing stage, the signal undergoes further pre-processing and filtering. The suitable pattern based on the mental command is selected by using windowing technique. The signal is converted into digital data which is given as input to the micro-controller. The micro-controller does the classification of each mental command based on the feature extraction. In the training phase, users will be trained for five basic commands (sitting, standing, forward movement, right turn, left turn). The recorded patterns during the training phase will be used by the micro-controller for decision making. The recognized thought patterns will be mapped to five different commands. During the testing phase, the controller makes use of machine learning to recognize and match patterns in the input data along with the training data that is already stored in the system to make the necessary decision regarding the action to be performed. The activation command to the exoskeleton is given by the controller through the Bluetooth module. At the receiver side the micro-controller converts this command into motor action which in turn moves the desired parts of the exoskeleton. Using a three-level sensing mechanism, feedback is given to the micro-controller regarding the status of the exoskeleton. Based on this feedback the micro-controller makes the desired corrections on the activation signals. The sensory feedback gives more stability to the system, and moreover rescue messaging systems are also implemented in case of emergencies.

9. Applications / Socioeconomic importance

(The relevance, if any, to the utilization and management of the natural resources of the State)

As per the “Disability Census 2015” 2.2% of the Kerala state population is suffering from various disabilities. This project can have impact directly on approximately 8 lakhs people in Kerala and 21 million people in India. The major applications of the proposed project and its importance are listed below

1) The proposed Brain Actuated Assistive Technology for the Paralyzed (BAATP) will bypass the brain clotting and help the paralyzed person to move their paralyzed parts using Muscle stimulation

2) Our product is unique because we are incorporating rehabilitation and communication assistance in the same system itself. The Multi-dimensional system helps in Rehabilitation and intuitive communication for the paralyzed. Most of the existing assistive devices provides only rehabilitation/motion

3) Non-invasive alternative to currently existing exoskeleton designs, which is lightweight and easy to Lift

4) An adaptive mechanism based on sensory feedback integrated with the exoskeleton to reduce, accidental fall rates

5) The BAATP uses a flexible Exoskeleton design which can be customized according to the degree of disability

6) Caregiver Interventions are minimized with the use of deep learning algorithms. Most of the existing systems require dedicated caregivers

7) The proposed system provides better classification accuracy and reduced false rates.
8) Deep learning algorithm helps to reduce mental fatigue and provides continuous Control
9) The major advantage of this innovation is that it can be applied to any existing assistive technology like MMIP (muscle to muscle interface for the paralyzed), Exo-skeleton etc. with minor modifications
10) This system can be easily passed down to any living beings which is having communication disabilities
11) The proposed system will be a great communication aid for paralyzed to express their thoughts and feelings with dear and near ones, thereby enhancing the quality of life

10. Scientific background of the project

a) Importance of the problem

1. The solution to the proposed problem can have direct/indirect impact on 21 Million peoples in India and 100 million people world-wide as per the Reeve foundation survey
2. Problem is aimed at enhancing the quality of life of the paralyzed
3. The Multi-dimensional system helps in Rehabilitation and intuitive communication for the paralyzed. Most of the existing assistive devices provides only rehabilitation/motion
4. Project can have impact on the existing exoskeleton designs, making it lightweight and easy to carry
5. Caregiver Interventions are minimized with the use of deep learning algorithms. Most of the existing systems require dedicated caregivers
6. Enhance user experience by reducing mental fatigue and provides continuous control
7. The proposed solution to the problem will be a great communication aid for paralyzed to express their thoughts and feelings with dear and near ones

b) Related work already performed or in progress at your organization or in the state.

1) Muscle Machine Interface for the paralyzed (MMIP) at SCMS School of engineering and technology, Karukutty
2) Brain Controlled Robot at SCMS School of Engineering and Technology, Karukutty

c) Related work already performed or in progress at other places in India or abroad.

1) BCI based Control, CDAC, Noida
2) Brain Control devices,CBR,IISc Bangalore
3) Re-walk Robotics,USA is an innovative medical device company that designs, develops, and commercializes robotic exoskeletons,
4) Home automation and smart wheel chair based on Electroencephalography (EEG) signals produced in brain",BITS,Pilani

11. Details of any preliminary work done by the investigator

- Literature survey and market study of existing Assistive devices, Identified the gaps in existing designs
- Tie-up with Sunrise hospital,Kochi to interact with paralyzed persons and medical practitioners
- Tie-up with NeuroSky and Backyard Brain, USA for expertise in EEG sensor design
- Real-time EEG data Acquisition and Analysis using Emotive EPOC mobile EEG headset
- Customized EEG sensor designed with 16 Electrodes
- Exoskeleton designed for the actuation of the affected lower Limb
- Implemented and Tested Brain-Controlled lower limb exoskeleton on the paralyzed patients and healthy subjects
- Developed an alternative method for Muscle stimulation without using exoskeleton
- Brain signal Analysis using realistic head models

Figures of Implementation/Simulations

Figure 1. Emotive EPOC mobile EEG headset

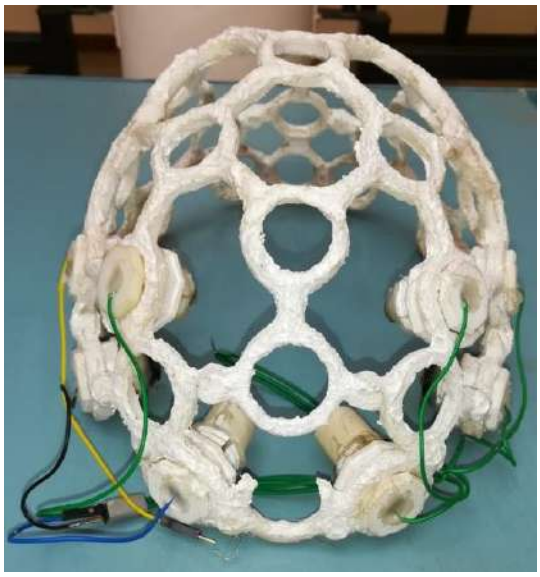


Figure 2. Designed EEG Sensor with electrodes

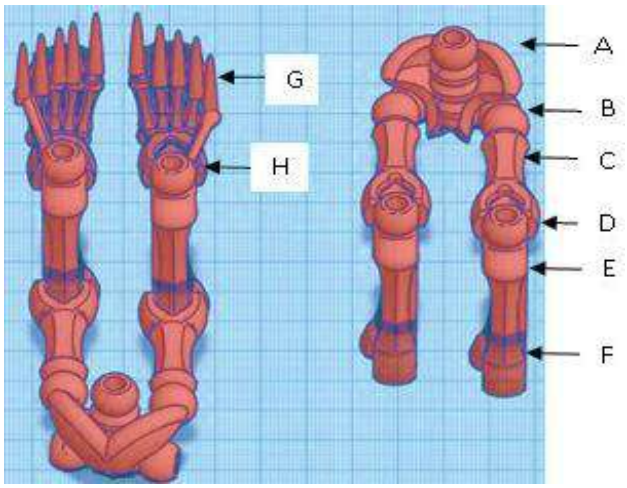


Figure 3: Complete Lower body part exoskeleton (3d Model designed)

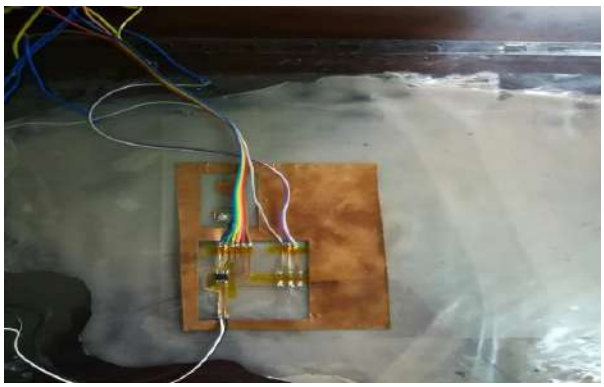


FIGURE 4. Artificial Skin along with processor and sensor circuit

FIGURE 5.Controlling the outer structure of exoskeleton using EEG headset

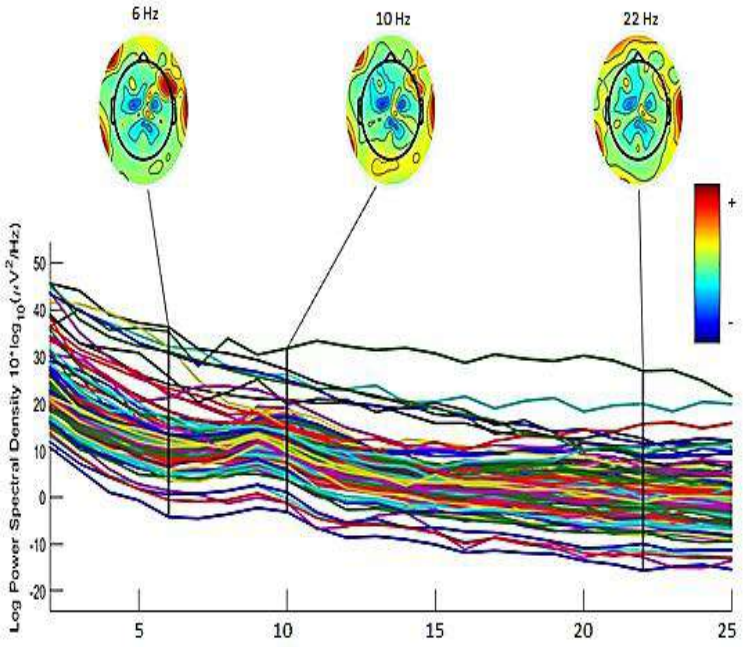


FIGURE 6. Brain pattern variations at different frequencies

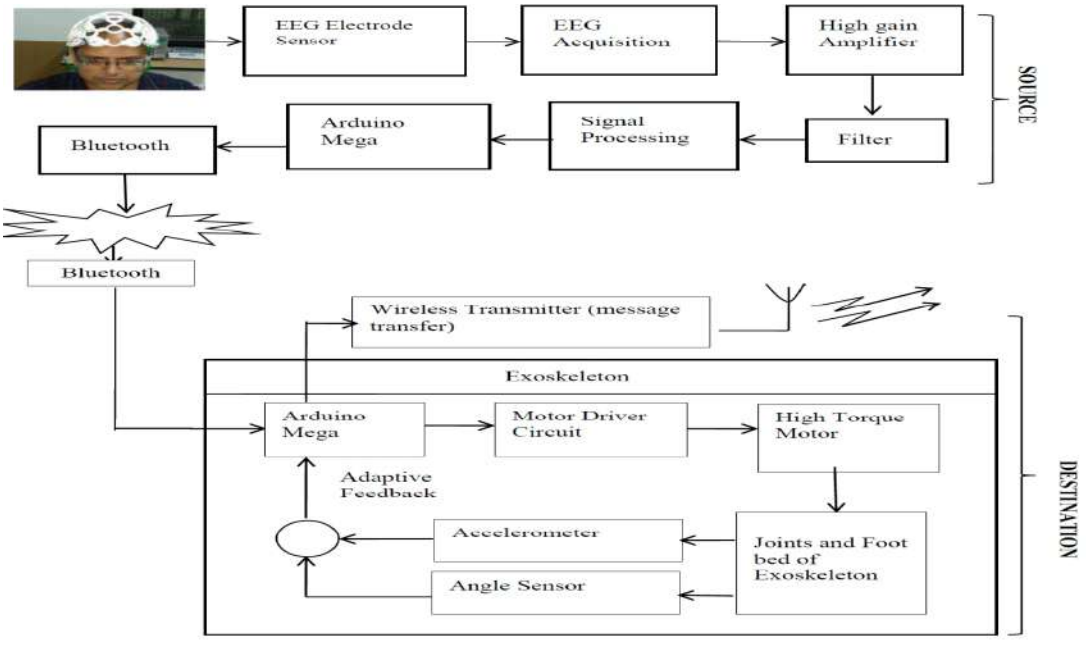


FIGURE 1. System architecture of Brain Actuated Multidimensional Exoskeleton

12. Detailed year wise work plan (Indicate methods / Techniques to be used)

Brain Actuated Assistive Technology for the paralysed(BAATP) Project Plan for 24 months

Activity	Plan Start (months)	Plan Duration (months)	Period in Months																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Design of EEG sensor, Muscle stimulation Unit,Signal Contition Unit,Brain signal analysis using Realistic Head models	1	6																								
Mechanical Design of Exoskeleton,Microtroller Programming for Algorithm Implementation, Interfacing of EEG sensor and Exoskelton with Microcontroller,System Integration and Testing	7	6																								
Real time data Collection and Analyses,Intergration of Artificial Muscle Intelligence,Deep-learning Model development, Online Testing using the Model	13	7																								
Usability Testing of the integrated prototype device on paralyzed patients,Incoperating Feedback from patients and Medical Practitioners,Final Assembly and Testing	20	5																								

13. Particulars of equipment required

1) 3D printers
2) CNC Machine
3) Soldering and Drilling machine
4) Electronics work bench
5) Laser Cutter
6) PCB Milling Machine,CRO,Digital Oscilloscope

14. Particulars of any other facilities required

NIL

15. **Particulars of the facilities that will be provided by the institution where this project will be implemented**

1)3D printers
2) CNC Machine
3) Soldering and drilling machine

16. Whether the project was submitted to any other organization for financial support

NO

17. Budget Details: Estimated expenditure

Sl No	Items	Amount (Rs)
1	Consumables **(Do not exceed 20% of the total amount)**	40,000/-
2	Equipment (For Private self-financing Colleges, 50% of the actual Equipment cost subject to the maximum of sanctioned amount shall be borne by the college)	1,40,000/-
3	Travel **(Do not exceed 10% of the total amount)**	10,000/-
4	Contingency **(Do not exceed 10% of the total amount)**	10,000/-
	Total	2,00000/- (Two Lakhs Only)

Budget Justification:

1. Consumables : Rs 40,000/-(Forty Thousand)

- EEG/EMG, Pressure,Accelerometer,gyroscope sensors,cables,Controller Boards,shields,Actuators,Motors,Batteries and Other electronic Components

2. **Equipment :** Rs 1,40,000/-(One lakh Forty Thousand)

Rental for Equipment Like 3D printers, Laser Cutters, NC Machines, Purchase of electronic Equipment like Multi-meter, soldering Iron, material for 3D printing, drill bits, Acrylic and plywood sheets for laser Cutter

3. **Travel**: Rs 10,000/-(Ten Thousand)

- Travel Budget will be utilized for meeting doctors, patients and subject experts

4. Contingency: Rs 10,000/-(Ten Thousand)

- Contingency Fund is utilized for patent filing, medical committee approval, to cover unforeseen risks during patient usability testing.

18. **The sources of funding the project including funds from other agencies from which financial assistance is obtained/expected to be obtained, and the quantum of assistance from each agency**

NIL

19. Quantum and nature of assistance expected from the CERD KTU

Financial and Technical support to implement the project

20. Name and address of the authority of Institution authorized to receive the grant

Dr.PRAVEENSAL C J,
PRINCIPAL, SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY,
VIDYANAGAR, PALISSERY, KARUKUTTY, ERNAKULAM-683576

21. **Whether grant under this scheme had been availed earlier by the investigator:** NO (If so, provide details)

22. **Details of projects already undertaken by the Principal Investigator with any other funding agency**

1. KSCSTE funded student project “Mute Horn”-A device to reduce sound pollution with a funding amount of Rs 10000/- on January 2020 as Principal Investigator
2. KSCSTE funded student project “Wearable device for detection And Prevention of Heart Failure” with a funding amount of Rs 15000/- on January 2017 as Principal Investigator
3. Manorama Yuva Mastermind Funded student Project “Wearable device for detection And Prevention of Heart Failure”with a funding amount of Rs 10000/- on April 2017 as Mentor
4. KSCSTE funded student project “Bionic haptic Arm” with a funding amount of Rs 15000/- on January 2016 as Co-Investigator
5. KSCSTE funded student project “Eco-friendly Traffic Junction” with a funding amount of Rs10000/- on January 2020 as Co- Investigator

Declaration

Certified that the details furnished above are correct to the best of my knowledge and belief and that the amount of financial assistance, if granted, will be utilised for the purpose for which it is granted within the time prescribed by CERD KTU. I also undertake to abide by the rules and other conditions prescribed by the grantee.

VINOJ P.G

Name and Signature
of the Investigator

Name and Signature
of the Prof-in-charge
CERD Satellite Centre

Name and Signature of
Head of the Institution

DR. PRAVEENSAL C.J.
PRINCIPAL
SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY

(Office seal)

SCMS SCHOOL OF ENGINEERING & TECHNOLOGY
KARUKUTTY
ERNAKULAM
683 582

Place: Karukutty

Date: 14/1/2021

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CENTRE FOR ENGINEERING RESEARCH AND DEVELOPMENT
College of Engineering Trivandrum Campus
Thiruvananthapuram.
Pin 695 016

RESEARCH SEED MONEY

Name & address of the Principal Investigator:
VINOJ P.G, ASSISTANT PROFESSOR,
ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT, SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY, VIDYANAGAR, PALISSERY, KARUKUTTY, ERNAKULAM-683576
MOBILE NUMBER: 9446276238 EMAIL:vinojpg@scmsgroup.org

Title of the Research Proposal: Brain Actuated Assistive Technology for the paralyzed

Broad Subject area/field of classification: Brain Computer Interface (BCI), Medical Electronics/Assistive Technology

Terms and Conditions

1. The scheme is constituted for the purpose of providing assistance in the form of grants to initiate research work in Engineering and Technology with particular relevance to the State of Kerala in the economic and industrial development.

2. Grant will be released to the Principal Investigator of the project through the Head of the institution.

3. The maximum duration of the project will be three years from the release of grant.

4. On completion of the project, one copy of the final project report on the work done should be sent to the CERD KTU along with the utilization certificate (UC), certified bills, bill wise statement and statement of expenditure (SE). Copy of the relevant pages of the Bank pass book should also be attached along with the documents for settlement.

5. The institute shall maintain separate audited accounts for the project.

6. The institute shall not entrust the implementation of the work for which the grant is being sanctioned to another institution nor shall divert the grant receipts to other institute as assistance.

7. The CERD KTU reserves the right to terminate the project at any stage if it is convinced that the grant has not been properly utilized or appropriate progress is not being made. In addition, the CERD KTU may designate a Scientist/Specialist or an Expert Panel to review the work done.

8. If the PI to whom the project has been sanctioned leaves the Institution, the Head of Institution/PI shall inform the same to the CERD KTU and in consultation with the CERD KTU, evolve steps to ensure successful completion of the project, before relieving the PI.

9. Investigators must acknowledge the CERD KTU in reports and technical/scientific papers published based on the research work done under the project. Investigators are requested to publish some of the research papers emerging out of the project work in leading Journals.

10. If the results of research are to be legally protected by way of patent/copy rights etc. the results should not be published without action being taken to secure legal protection for the research results.

11. The knowledge generated from the project will be the property of the CERD KTU and should be properly acknowledged. Transfer of technology generated shall be done in consultation with the CERD KTU.

12. For Private self-financing Colleges, 50% of the actual Equipment cost subjected to the maximum of sanctioned amount will be reimbursed by KTU if and only if the proof of remittance of other 50% is produced by the college.

13. Equipment details must be entered in a separate stock register for the RSM project signed by the investigator, lab in charge and Principal. A separate stock entry certificate has to be furnished by the Principal Investigator with the authentication of Head of Institution.

14. The grant amount should be deposited in a separate bank account in the name of the Principal investigator and Head of Institution jointly.

15. The interest accrued shall also be accounted in the project.

16. If the project is not completed within the time limit, the grant amount should be reimbursed along with interest accrued.

17. The CERD KTU may enforce additional guidelines for the operation of research project from time to time and the Institution/Investigators are required to observe such directions in the conduct of the research work.

We agree to the terms and conditions stated above.

VINOJ P.G

Name & Signature of
Principal Investigator

Name & Signature of
Prof-in-charge
CERD Satellite Centre

SCMS SCHOOL OF ENGINEERING & TECHNOLOGY
KARUKUTTY
ERNAKULAM
683 582

(Office Seal)

Name & Signature of
Head of Institution

DR. PRAVEENSAL C.J.
PRINCIPAL
SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY

Research progress report (RSM CERD Research Seed Money)

Details of Project

Title of Project: Geometric design consistency evaluation criteria for two lane rural combined curves

Name of Principal Inevstigator: Y K Remya, Asst Prof., CED

Amount Sanctioned: Rs1,20,000/-

First allotted money: Rs60,000/-

Relevance of the topic

Relevance of the topic can be understood from the following facts:

- Though Kerala is a small state constituting only 1% of total area of our country, more than 3 lakh km long road network exists. So a large number of different types of curves are a common phenomenon.
- Rollover crashes of commercial vehicles at curves are mostly serious and cause severe damage and injury than other kinds of vehicle crashes.
- The relatively low roll over stability of commercial heavy vehicles promotes rollover and contributes to the number of heavy vehicle crashes.
- The lateral stability of a commercial heavy vehicle changes with the load distribution as the position of centre of gravity of loaded heavy vehicle varies.
- Lateral stability of a heavy vehicle also depends on its suspension characteristics while traversing a horizontal curve.
- Vehicle stability also depends up on geometry of the highway and on operating speed.

So this study focuses on rollover potential of heavy vehicles carrying different load distributions and to arrive at critical or unsafe load conditions. The influence of suspension characteristics of the vehicle on its lateral stability while negotiating a horizontal curve will also be studied. Moreover the study aims to determine how geometry of a curve and operating speed of vehicle influence lateral stability of the vehicle. The research also attempts to compare field study with computer simulation/mathematical modeling techniques.

Literature review

Literature are being collected and grouped into the following subgroups

- Literature giving Basic understanding of vehicle rollover phenomenon and point mass model
- Research on vehicle stability using computer simulation
- Research on vehicle stability using field study

- Literature evaluating geometric design consistency and safety

The following gaps in previous research are identified

- Current design guidelines for horizontal curves in India are based on AASHTO guidelines which were developed in consistent with studies done outside India. The adaptability of these design guidelines to Indian conditions is not investigated yet.
- Guidelines for geometric design of reverse curves and combined curves under Indian conditions are not developed yet.
- The effect of distribution of load carried by trucks on its stability at various operating speeds is not studied.

Innovation expected

- Expect new design guidelines for horizontal curves considering vehicle stability
- Safety engineers could select appropriate speed limit for heavy vehicles on different types of horizontal curves.
- Vehicle operators could identify the critical or worst load distribution condition of heavy vehicles and can avoid the situation of rollover of heavy vehicles.
- Road safety audit tool for rural highways handling freight transportation.

Methodology planned

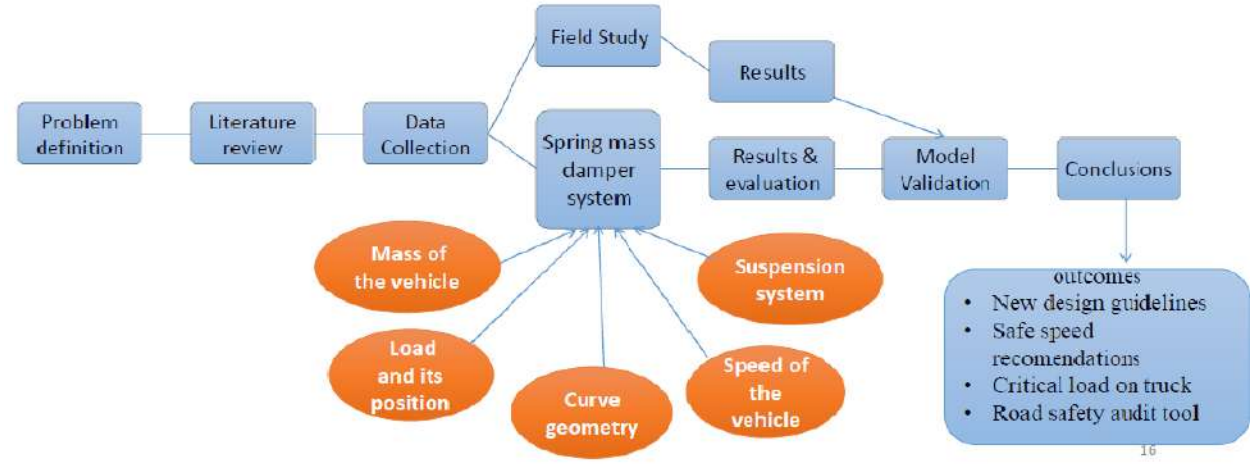


Figure 1: Flowchart showing research organization

Details of progress of research

Physical progress Crash data during 2016,2017 and 2018 collected

1. Selection of study truck(Figure 2). Characteristics of study truck shown in Table 1

2. Geometric data for simple horizontal curves and combined curves collected using total station equipment and GPS (Table 2)
3. Field survey using two axle truck equipped with Androsensor application for different loading conditions like empty condition, partial loading conditions and fully loaded condition.

Figure 2: TATA SE 1613 truck

Table 1: Characteristics of Test vehicle: TATA SE 1613 Truck and Nissan Terrano

Sl. No.	**Vehicle Characteristics**	**Truck**	**SUV**
1	Vehicle model	TATA SE 1613	Nissan Terrano
2	Gross Vehicle Weight	16200kg	1770kg
3	Suspension	Semi elliptical multi leaf spring, hydraulic double acting telescopic damper	McPherson Strut with Coil Spring Stabilizer Bar & Double Acting Shock Absorber
4	Overall height	2460mm	1671
5	Overall length	6970mm	4331mm
6	Overall Width	2434mm	1822mm
7	Track width	1890mm	1560mm
8	Wheel base	4225mm	2673mm

9	Centre of Gravity height from ground level	873mm (Empty truck) 1489mm (Truck loaded upto GVW)	835mm
10	Ground Clearance	259mm	205mm

Table 2: Summary statistics of geometry of study curves.

Sl. No	Curve Type	No. of curves	Geometric data collection Status
1	Simple Horizontal curves	91	Completed
2	Combined curves	68	Completed
3	Reverse curves	On Progress	

Collection of lateral acceleration data

The lateral behaviour of test vehicles on study curves were determined by collecting real field data through an extensive field survey. Acceleration sensor available in android phone was used for collecting lateral acceleration experienced by the vehicle. It shows in real time how much force is applied on it in the form of acceleration. The x, y and z axis show the direction of the force. x is relative to the left and right sides of the phone as you hold it looking at the screen. y is relative to the up and down sides of the phone as you hold it looking at the screen. z is relative to the front and back sides of the phone as you hold it looking at the screen. The android phones with 'Androsensor' application installed in it were mounted at six different positions inside the test vehicle as shown in figure 2, four of which were fixed above the front and rear wheel positions and the remaining two were fixed above the centre of the front and rear axles. The androsensor application gives the following data:

a) Acceleration in X, Y and Z directions
b) Geographic Location in Latitude, Longitude
c) Instantaneous speed
d) Date and Time

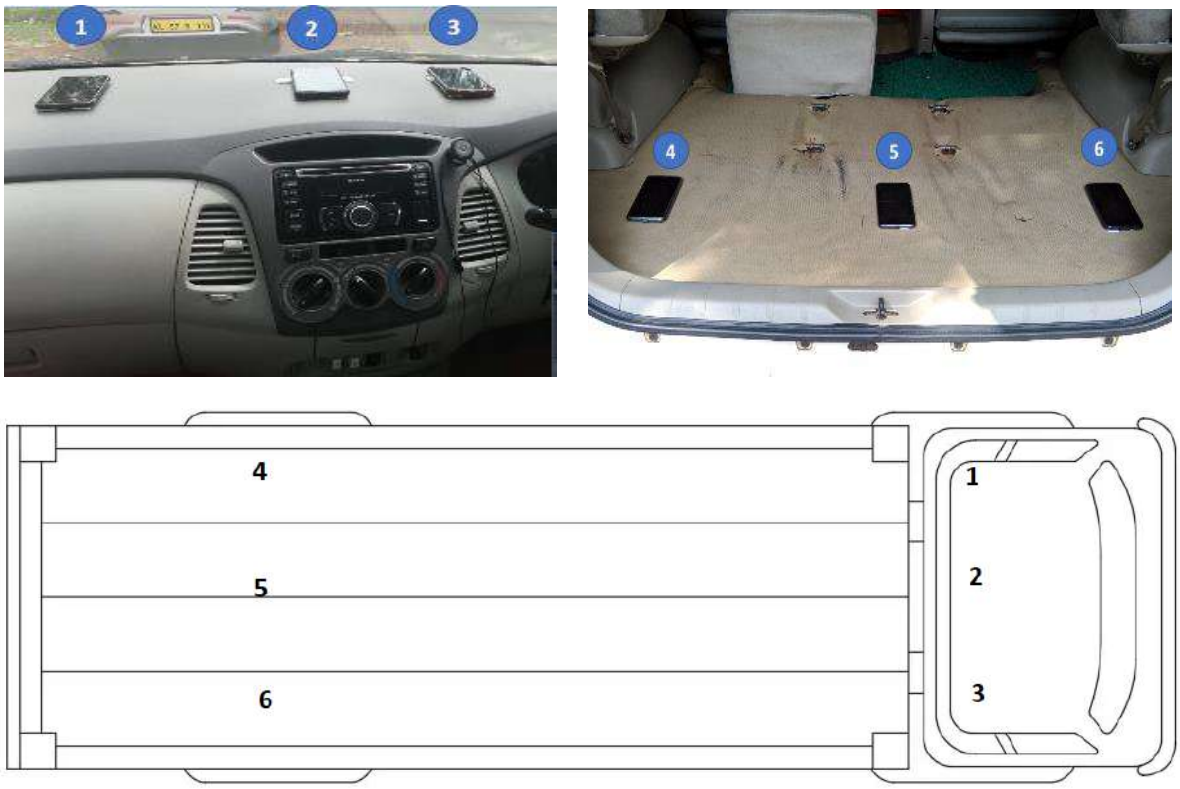


Figure 3: Sensor Positions on SUV and Truck: 1: Front left; 2: Front mid 3: Front right; 4: Rear left; 5: Rear mid; 6: Rear right

The test vehicles were operated through the study curves under natural conditions with sensor active. Test runs were conducted during off peak hours. Also, a number of trials were repeated to improve accuracy of results and to eliminate possible errors due to influence of other vehicles if any. Later, the large data set recorded by the sensor was retrieved, sorted, grouped and analyzed to obtain lateral acceleration experienced by the test vehicle along each study curve under different sensor positions and trials. Test runs were performed under dry weather conditions for SUV, empty truck and fully loaded truck.

Work to be completed

Geometric data collection of remaining curves

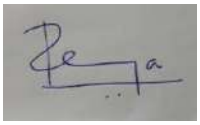
Lateral acceleration data collection using field survey for partial loading cosnitions

Data Analysis

Discussion of results and drawing conclusions

Time plan of the remaining tasks

Sl. No.	Activity	July-sep 2023	Oct-Dec 2023	Jan-March 2024	April-June 2024	July-Sep 2024	Oct-Dec 2024
1	Geometric data collection						
2	Field survey(data related to lateral stability of trucks)						
3	Data analysis and interpretation						
4	Discussion on results						
5	Drawing conclusions						
6	Generating outcomes from the model						



Signature of the Principal Investigator